

# DEVELOPMENT OF A MOBILE LEARNING APPLICATION TO SUPPORT E-LEARNING AND ANALYSIS OF ITS EFFECTS

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## ABSTRACT

*It should not be disregarded that e-learning applications have some limitations although they provide many opportunities to people who have different expectations and characteristics and who want to make use of educational opportunities. When the limitations of e-learning and the advantages of m-learning applications which these limitations provide are considered together, they may serve more effective learning contexts for individuals. In this study, an m-learning application was developed to assist e-learning and it was supplied for learners who attend distance education to use. As a result of the study, it was provided for learners to attend educational events without real time and place limitation in reality via using m-learning as an assistant for e-learning. Furthermore, learners were provided to be informed about course cancellations, assignment deadlines, exam dates, the announcement by school administration immediately, and so on. As a result of the study, learners' views for this application were taken into consideration and it was stated that m-learning application was effective for learners in education at anytime and anywhere.*

## KEYWORDS

*Mobile Learning, E-learning, Distance Education, Software Development*

## 1. INTRODUCTION

Mobile phones have become smaller, stronger and more popular with the help of rapid development of mobile technologies [1]. Mobile phones are used in various fields in daily life. A number of mobile applications have been developed for mobile devices. The users can reach information via these applications without the limitation of time and place. Mobile phones can be useful to learn via appropriate designs with the help of characteristics such as mobility and instant communication although the characteristics of mobile phones like screen size, battery capacity, data and ram capacities limit the use of these devices in learning context [2].

Studies reveal that in order to overcome the limitations of e-learning such as using them only in contexts where there are computers and internet connection, causing learners to feel isolated and to have motivational problems and being incapable of providing instant message, m-learning applications have the advantages. Some of them are providing the opportunity to study without the limitation of time and place, using instant communication devices like SMS and MMS and having motivational impact [1] [2] [3] [4] [5] [6] [7].

In this study, definitions of distance education, e-learning, m-learning and their applications were investigated in the literature. According to the results, it was endeavored to reveal the advantages and limitations of a mobile application that was developed as an assistant to e-learning.

## 2. RELATED WORKS

According to the approach put forward by Georgiev [8], Figure 1 shows the relationships between learning paradigms. This approach considers m-learning as a part of e-learning, e-learning as a part of distance learning. Furthermore, an m-learning activity is seen as an e-learning and an e-learning activity is considered a distance education activity.

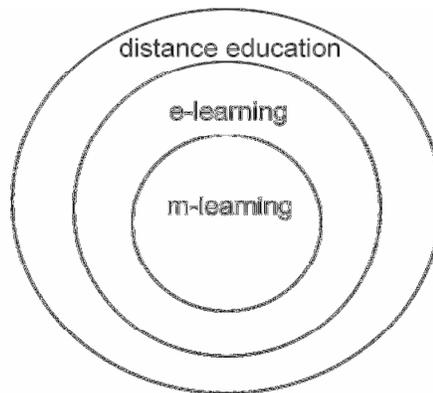


Figure 1. Set theory perspective of learning paradigms [8]

Akour [9] compares learning paradigms with respect to flexibility provided for learners and learning time span. When traditional learning, distance education, e-learning and m-learning are compared, it is stated that m-learning has a more learning time span. It is acknowledged that m-learning is used by a lot of learners since it can be reached at anytime and anywhere and also provides easy access. Akour [9] compares in terms of flexibility and learning time spanning of traditional education, distance education, e-learning and m-learning paradigms (Figure 2).

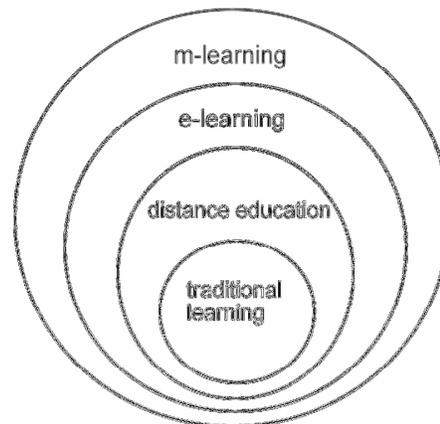


Figure 2. Learning space range and ease of access for learning paradigms [9]

Tick's approach [10] is thought to be the best for this study as it states that m-learning can provide educational opportunities at anytime and anywhere when used with e-learning and distance education. Figure 3 shows the relationship between learning paradigms according to this approach.

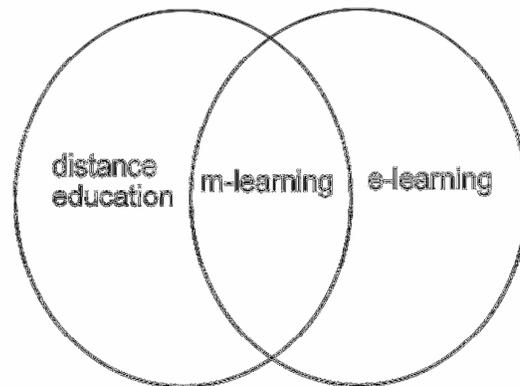


Figure 3. The interrelationship of d-learning, e-learning, and m-learning [10]

In m-learning studies, Saran [7] developed an m-learning context for university students' language studies. At the end of the study with the help of sending contents of courses, an increase on learners' learning performances and motivation levels has been observed. The reason for this increase has been thought to be the mobility of mobile phones, their utility in flexible hours, and using them in educational activities via direct access opportunity. As a result of their study which was conducted to decide the learners' views on their utility of mobile phones on learning activities, Norman et al. (2010) concluded that learners claim that mobile phones have increased their learning performances, curiosity and have helped them to be motivated. Lan and Sie [1] developed a mobile application to increase the participation of unsocial learners who do not participate in class activities like question & answer. With this application, learners can ask questions to their tutors via their mobile devices without revealing their identities. According to the results of this study, it has been stated that learners are satisfied with the mobile application and they participate question & answer activities more. Chen et al. [2] developed a learning context for high school students. Learners are divided into control and experimental groups. Experimental group learners, provided with learning contents via SMS on their mobile phones besides web-based learning contexts, were given informing and reminder facilities on learning activities. As a result of the study, it is revealed that experimental group learners' participation in learning activities and their level of success were found to be higher than control group. Fetaji and Fetaji [4] developed an application that includes assignments, course contents, and course recordings for university students regarding with browser features of mobile phones. Upon analyzing the application results, it was observed that learners' motivation was decreasing gradually and that learners' motivation should be kept high. Hashim et al. [5] conducted a study with the aim of designating the factors that affected the utility of m-learning applications. It was acknowledged that flexibility, appropriateness, instruction, design, using the least amount of memory resource were effective in the utility of m-learning applications. Marcos et al. [3] designed a web based learning context and a mobile learning context as an alternative to the web based learning context for university students. Learners were enabled to use either web or mobile learning contexts during the study. When learners' grades were considered at the end of the study, an increase was observed in the success of learners who used the mobile application. Learners mentioned that the mobile application was not satisfactory enough to provide motivation and participation in the learning activities. It was concluded that m-learning applications enriched by new exercises and learning activities could be more effective.

These studies were observed to focus on the topics such as determining learners' attitudes towards and motivation in m-learning applications, the effect of m-learning applications on learners' success, investigating the effects of the utility of m-learning and e-learning together. During these studies, the focused group take face to face education and they are provided with m-learning. It is useful to present flexible m-learning with the e-learning context supported by m-learning applications to learners who attend distance education programs as well as those who attend face to face education.

One of the primary aims of distance learning is to present education anytime and everywhere. Therefore, distance education applications should be designed in a way, that is, to provide them maximum access options by considering learners' access restrictions. Distance education learners can reach educational events at their convenience. Learners are able to communicate with the tutor and other learners via e-mail, e-learning and forum tools. However, in order for a learner to be able to access them, learners need to be in a place where computers and internet connection are available. When these limitations of distance education were observed, the importance of making use of m-learning advantages was understood [2] [11].

It is a significant issue that both to develop m-learning applications with the aim of solving the limitations such as not being able to present the mentioned educational facilities anywhere and at anytime, learners' experiencing motivation problems and their feeling isolated, their being informed on the announcements about learning events made by the school management later, and to evaluate the effects of these applications [2]. This important problem establishes the basis of this study.

### **3. METHODOLOGY**

#### **3.1. Participants**

Gazi University Distance Education Vocational School learners were sent a message about the application. Some information about mobile application was given to these learners and the ones who had mobile phones with 3G and wireless and who wanted to participate in application within the message were asked to reply the message. 21 of them accepted this request. However, those who couldn't go on studying because of their personal excuses were omitted from the study and so, 13 learners were analyzed.

#### **3.2. Measurement Tools**

Interview form was used in the collection of the data and instructors were interviewed. What's more, recordings of learners who use the mobile applications regularly were saved in the database and these recordings were analyzed at the end of the application.

'Diffusion of Innovation' theory was analyzed during the preparation of student view form and relative utility, appropriateness, and complexity dimensions were taken into consideration [12]. This form was presented to expert opinion, and the form was redesigned after considering the feedback of experts. The student view form consists of 20 open ended questions.

Unstructured interviews were done with the instructors. Some parts were noted down. Those parts were analyzed via content analysis.

#### **3.3. Mobile Learning Environment**

In this study, a mobile application and accordingly a web application were developed for instructors. The instructors can fulfil certain works such as adding the content for mobile

applications and following the log records of learners who participate in these applications. The necessary information about mobile and web applications are provided below.

M-learning application was developed in order to support e-learning via using PHP programming language. MYSQL as database, LINUX as operating system and APACHE environment were used as server.

The study consists of two sub-studies. One of them is the mobile application that provides mobile learners' reaching course contents via mobile phones, watching course videos, listening to course recordings, and the negotiation between teachers and learners. The other one is the web application that helps teachers add course contents through PCs or laptops and see learners' log recordings.

This mobile application enables to reach course contents via 3G or wireless connection of mobile phones' web browsers. During the phase of developing mobile application, mobile software preparation principles were taken into consideration acknowledged by Qing Tan and Kinshuk [13]. Mobile application pages were in HTML format and were designed via using CSS appropriate for the small screens of mobile phones.

When the learner writes the address of m-learning application on the browser via his mobile phone, the home page in Figure 4 appeared. The learner must enter his password and user name to the form in order to open the application.



Figure 4. Login page



Figure 5. Home page

When the learner opens the page successfully, he is led to a page as it is in Figure 5. This is the home page of this application. There is a red exit symbol at the top of the home page, which assists us to exit from the application. There are notice texts to inform learners about the new messages or announcements below the exit symbol. Also, there is a menu in which links for other pages involve at the top of the home page. This menu is available at the top of each page.

Message board tool was developed in order to establish interaction between teachers and learners. It is possible to reach the message board on the home page. When the 'my messages' link was clicked on, the inbox was seen. The learners can see the sent box, sender and sending date on this page. Furthermore, when the learner clicks on the link 'friends', he can see his other classmates who use this mobile application. Learners have the chance of messaging instantly with their online classmates via this page.

When the link 'class notes' is clicked on the menu, some pages in which there are course contents similar to display images (Figure 6). Course contents in mobile applications were added by the teacher with the help of web application. Mobile application contents were recorded as topics and content summaries to the database due to the small screens of mobile applications and limited resources.

Learners and teachers participate in virtual activities via e-learning applications weekly. These learners can watch the weekly designed video recordings and listen to the audio recordings when they click on the link 'course videos' from the m-learning menu.

It is quite difficult to watch videos from the mobile phones due to the variety of operating systems of phones, the capacity of mobile browsers and connection speed. Considering these problems, video and audio recordings were arranged in two forms. The first one is FLV format that can be viewed and listened to via Flash Player, and the second one is MP4 format that can be viewed and listened to via HTML5 harmonious with browsers. The user can reach both video and audio recording via another format if he happens to come across any problem while listening to and/or watching the video.

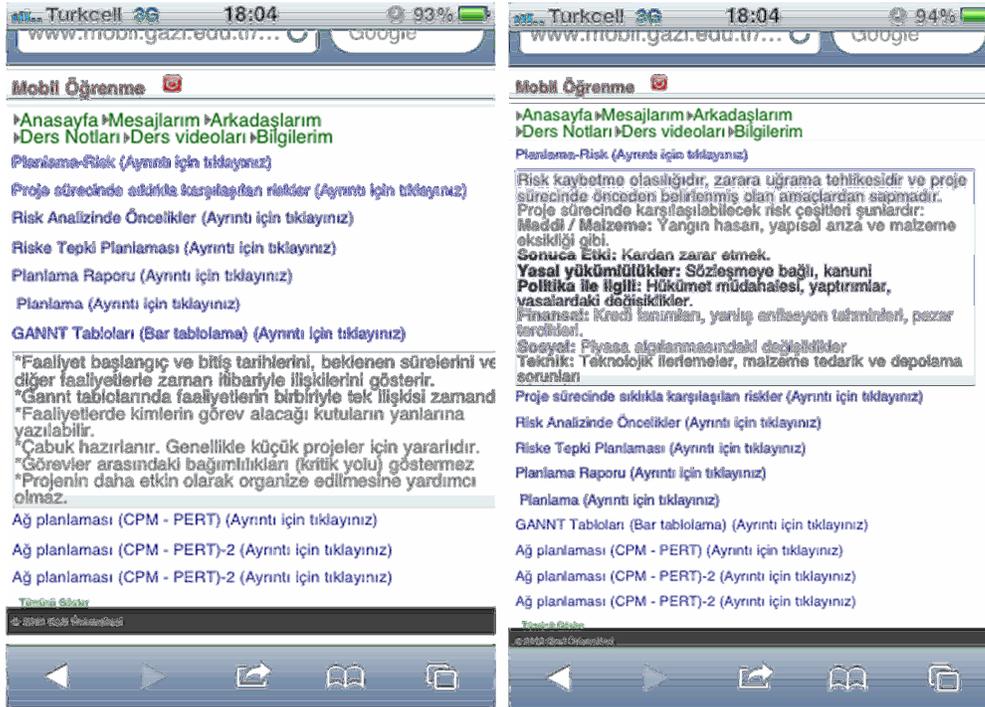


Figure 6. Course Content Pages

Another application designed as a part of this study is web application for instructors. The instructors can add course contents for mobile application from PC or laptop via this application, examine learners' log recordings and send messages to learners via mobile application.

### 3.4. Procedure

This mobile application was applied in Maths, Research Techniques and Project Management courses by Gazi University Distance Education Vocational School students. The application process lasted for 6 weeks.

Weekly course contents were added to the application database during the study. The recordings of virtual class applications were transmitted into mobile application environment by transforming into video and audio formats appropriate for mobile phones. Mobile applications were permitted to be accessed only through mobile phones in order to understand the utility and effectiveness of mobile application, and access via PC or laptops is hindered.

During the application, learners were informed about course cancellations, postpones, assignment due dates, examination dates and overall announcements from the school management. It was aimed to raise learners' participation in the virtual class applications by sending reminding SMSs to learners an hour before these classes as virtual class applications were thought to be an important activity for distance education learners.

### 4. RESULTS

The answers given to the question of whether the m-learning application met learners' expectations or not were analyzed. 6 students (46.15%) acknowledged that the application had enough qualifications to meet their expectations. 3 students (30.77%) claimed that m-learning application had above and beyond the qualifications, while 4 students (23.08%) stated that they could not participate in the virtual classroom applications so m-learning application did not meet their expectations.

The learners' answers were analyzed in terms of the contributions of the m-learning applications and the findings were displayed related to these questions in Table 1.

Table 1. Learners' views with contributions of m-learning.

Category	f	%
Being able to participate in the educational studies without time and place limitations.	8	61.54
Spending free time participation in the educational studies	2	15.38
Rising the participate into the virtual class applications with the help of SMS notification	2	15.38
Being able to participate in the educational studies when travelling	1	7.69

According to the findings, 8 students (61.54%) claimed that they could participate in the educational studies without time and place limitations. There are 2 students (15.38%) who stated that they spent their free time in participating the educational studies via their mobile phones. While 2 students (15.38) claimed that their participation into the virtual class applications with the help of SMS notification, 1 student (7.69%) told that he could participate in the educational studies with the help of m-learning application as he travelled a lot for his business. When the

answers and the situation in Table 1 were analyzed, it became clear that the learners took the advantage of this service.

The learners were asked about the negative sides or difficulties of m-learning application and the findings of these questions were displayed in Table 2. According to the results, 4 of the learners (30.77%) stated that the negative side of m-learning was watching the courses from the small screens of mobile phones and that those screens were too small to view the course videos. 3 of these learners (23.08%) considered not being able to participate in virtual class applications via mobile application as the negative sides of m-learning, while 3 of them (23.08%) claimed that the negative side of m-learning was reflection of internet connection fees via mobile phones to their bill. However, 3 of learners (23.08%) said that there was no negative side of m-learning application. When these answers are taken into consideration, it is clear that these are the basic problems of mobile applications.

Table 2. Learners' views with respect to negative sides of m-learning

Category	f	%
The difficulties of viewing course contents and watching video on account of small screens and connection problems	4	30.77
Not being able to participate in virtual classes via mobile phones	3	23.08
Reflecting mobile internet fees to the bill	3	23.08
Inexistency of any negative side	3	23.08

The learners were asked to compare learning management systems used during e-learning process with m-learning applications and the findings of their answers were given below in Table 3.

Learners compared e-learning application used as distance education service with m-learning application used to support this system in this question. 10 of them (76.92%) stated that computers and internet facility were required in order to access e-learning application while such a necessity did not exist for m-learning application so they added that m-learning was more useful in this respect. 2 learners (15.38%) said that being informed about educational studies via learner informing SMSs, but 1 learner (7.69%) said that accessing the course contents, video and audio recordings of courses that they could not attend were effective.

It is seen that m-learning application that was developed to remove the limitations of e-learning has achieved its goal when learners' views are analyzed. Furthermore, it is revealed that the independence of time and place was achieved in its real terms via m-learning.

Table 3. Learners' answers related to advantages of m-learning when compared with learning management system

Category	f	%
Being able to participate in the educational studies in places where there is no computer or internet	10	76.92

Informing via SMSs	2	15.38
The opportunity of accessing contents, video and audio recordings of previous courses	1	7.69

When learners are asked about how the connection fees to the internet via mobile phones have affected the utility of m-learning application, 8 of them (61.54%) stated that those fees did not affect the utility of m-learning application. However, 5 of them (38.46%) claimed that the fees of phone invoice increased due to the connection charges and that they were more careful about using the internet via their mobile phones less and less.

In Table 4, the number of page views and those pages on which the participants view via the application of m-learning during the application. When the numbers of page views are analyzed, it is revealed that students in total visit the contents page 579 times, home page 143 times, online friends page 135 times, and personal information page 46 times. Furthermore, students enter the m-learning application 456 times in total.

Table 4. The application pages students view during the application and the number of page view.

<b>Pages</b>	<b>F</b>	<b>%</b>
Course contents page	579	32.13
Home page	571	31.69
Video and audio recordings page	328	18.20
Inbox page	143	7.94
Online friends page	135	7.49
Personal information page	46	2.55

Unstructured interviews were done with the participant instructors on the web application developed during the study. According to the results, instructors acknowledged that the web application is practical and useful thanks to some facilities in terms of adding contents for m-learning program, analyzing students' log recordings, viewing the chat board of m-learning program, announcing, sending messages to students via e-mail and m-learning program. They also added that sending SMS to students' mobile phones was not available and this application could be more effective if this feature is included.

## 5. CONCLUSION

An m-learning program was developed as a supporting factor to e-learning with consideration of advantages and disadvantages of e- and m- learning. This program was used as pilot scheme by Gazi University Distance Education Vocational School students.

According to the results of this study, it was observed that thanks to the m-learning applications, students could participate in learning activities anywhere and anytime. As a result, the lack of providing conditions for education anywhere and anytime, and instant informing system of this e-

learning was erased via this program. Parallel to this study, Chen et al. [2] study revealed that students are glad with the combined use of e- and m-learning. The number of page views supports this finding as well. It is clear that students prefer to view course contents, video and audio recordings of these courses among the learning activities in e-learning program when the number of page views is taken into consideration. The reason of this may be the flexibility of this program. Students' motivation towards and participation in these learning activities increased with the help of informing and reminding SMSs. In this respect, this study is similar to that of Lan and Sie [1].

Some challenges and limitations such as too small screens of mobile phones to view course contents and course video recordings, connecting to the internet in places with limited signals and the high prices of mobile wireless connection caused them to suffer from different problems during the use of m-learning. These challenges and limitations were observed in the mobile learning application process designed by Nordin et al. [6]. It is found that m-learning should be used as supportive to e-learning as it won't be sufficient in distance education process.

It is decided that instructors are glad with the web application and that it is a missing point not to be able to send SMS to students via web application. Thus, it is thought to be more effective to provide the opportunity with sending SMS via web application.

Works such as making summaries of course contents, transforming video and recordings of courses into appropriate formats in mobile phones, sending SMSs were fulfilled by instructors and the researcher as m-learning program in this study did not run integrated with learning management system. Great time and effort were spent for these works.

It is recommended that m-learning and e-learning applications should be integrated for further studies. It is also suggested that content should be formed and added to database for m-learning during the process of forming contents for e-learning. It is necessary that sending SMS to students in database about the recorded academic affairs should be provided via web services of GSM operators by connecting to e-learning database with m-learning application. It is also considered to inform all students instantly via SMSs by gathering students' phone numbers.

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