A SIMULTANEOUS MOBILE E-LEARNING ENVIRONMENT AND APPLICATION

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ABSTRACT

The purpose of the present study was to design a mobile learning environment that enables the use of a teleconference application used in simultaneous e-learning with mobile devices and to evaluate this mobile learning environment based on students' views. With the mobile learning environment developed in the study, the students are able to follow a teleconference application realized by using appropriate mobile devices.

The study was carried out with 8 post-graduate students enrolled in Karadeniz Technical University (KTU), Department of Computer Education and Instructional Technologies (CEIT), Graduate School of Natural and Applied Science. The students utilized this teleconference application using mobile devices supporting internet access and Adobe Flash technology. Of the 8 students, 4 accessed the system using EDGE technology and 4 used wireless internet technology. At the end of the application, the audio and display were delayed by 4-5 seconds with EDGE technology, and were delayed by 7-8 seconds with wireless internet technology. Based on the students' views, it was concluded that the environment had some deficiencies in terms of quality, especially in terms of the screen resolution. Despite this, the students reported that this environment could provide more flexibility in terms of space and time when compared to other simultaneous distance education applications.

Although the environment enables interaction, in particular, the problem of resolution caused by screen size is a disadvantage for the system. When this mobile learning application is compared to conventional education environments, it was found that mobile learning does have a role in helping the students overcome the problems of participating in learning activities caused by time and space constraints.

Keywords: Mobile Devices, Distance Learning, Teleconference, Synchronous E-Learning, M-Learning

INTRODUCTION

As social beings, human beings have always been in close interaction with each other. These interactions are realized in various forms in line with the development of

communication and information technologies.. Today, mobile devices and communication technologies satisfy our communication needs easily and rapidly in different physical environments. The dictionary meaning of the term "mobile" is "mobility, movable" (TDK). The existence of an efficient, wireless connection to anywhere in the world had a significant role in emergence of mobile technologies (Bulun, Gülnar & Güran, 2004). Which are easy to carry and available for use anywhere and anytime. The general characteristics of mobile devices are their multifunctional in all areas of life, easy mobility, user-friendliness, easy-to use and economy (Keegan, 2005). After mobile internet technologies became widespread, wireless networks gained importance. With their mark-up languages, communication protocols and user interfaces, wireless networks provide an information source and required connections for the devices. Mobile devices include tools such as telephones, smart phones and lap top computers (Necat, 2007). The availability and ease of access of mobile devices suggests that teaching with these devices can have advantages for e students and teachers (Aubusson, Schuck & Burden, 2009). Using mobile devices, advanced support and guidance mechanisms, course management and management services can be provided to the students (Kukulska-Hulme & Traxler, 2005, p.26).

E-learning involves the utilization of information and communication technologies to support learning and   includes tools such as internet, databases, video conference (Unıversıty Of Alberta, 2005). Following the utilization of mobile devices in e-learning, the concept of mobile learning emerged. Mobile learning is the intersection of mobile devices and e-learning. E-learning and m-learning concepts are simply related to the distribution of the content in learning. While e-learning refers to the supporting of learning using electronic devices and media; m-learning refers to the learning realized via mobile tools and wireless communication technologies (Hoppe, Joiner, Milrad & Sharples, 2003). The term mobile can be considered in three different meanings in teaching, which are mobile in physical environment; mobile in different areas of life and mobile in terms of time (Vavoula & Sharples,2002). The opportunities offered by mobile devices in communication facilitate the enrichment distant education applications. Mobile learning offers strong searching opportunities, rich interaction, strong support and performance-based evaluation opportunities for effective learning.

Mobile learning makes e-learning independent from time or the physical environment (Quinn, 2000). When mobile learning and e-learning are combined, two characteristics appear: mobility and availability (Peng vd., 2009). This new mobile learning architecture supports creativity, agency transactions, the distribution and follow-up of information and learning content, easy access to daily life activities (concert, cinema etc.), easy access, spatial independence, personalization, multimedia, instant text and video messaging (Mobilearn, 2003).

There are two kinds of communication in e-learning and m-learning according to the realization time. These are synchronic and asynchronic communication technologies. Synchronic communication involves simultaneous communication methods such as written chat, audiovisual chatting while asynchronic communication involves communication methods such as non-simultaneous e-mails, forums or video records (Lundin & Magnusson, 2003). Asynchronic communication seems to be more appropriate for complicated opinion sharing like reflection and discussions, however, the students in this study, liked synchronic communication methods better. The students feel that synchronic communication allows more socialization (Hrastinski, 2008).

Teleconferencing is one of the synchronic communication technologies used in e-learning. The United States Distance Learning Association (USDLA) defines teleconferencing as an electronic communication technology in which two or more people can build a visual and/or audio interaction with each other from two or more different locations. Over one or two directional satellites, the participants can connect to each other electronically via video transfer, telephone, computer, facsimile or any combination of these devices (United States Distance Learning Association, 2006).

Although building teleconference systems is a high-cost activity, the applications realized via teleconference systems can now be used over the internet with web conferencing and live web publications being among these services. After these kinds of applications became widespread, a higher level of interaction opportunities can be achieved between students or from student to teacher.

Although temporal-spatial dependency in education-teaching activities is considerably reduced with distant education and more specifically, with e-learning, this does not mean that there is total freedom for the students and teachers. However, mobile learning is a step further to this freedom. The integration of E-learning applications, especially those realized by synchronic communication technologies into m-learning environment are of great importance. With the mobile learning environment they realized, Huang et al. (2008) provided students with the opportunity of accessing simultaneous distant education courses with mobile devices anytime and anywhere, without the need to sit in front of a desktop computer (Huang et al., 2008). Kekwaletswe and Ng'ambi (2006) carried out a study on the utilization of an instant messaging application used in simultaneous e-learning environments and also in mobile environment. The purpose of the present study was to design a mobile learning environment that enables the use of teleconference application used in simultaneous e-learning with mobile devices and to evaluate this mobile learning environment based on students' views.

METHOD

Sampling

The sampling of the study consisted of 8 post-graduate students enrolled in Karadeniz Technical University (KTU), Department of Computer Education and Instructional Technologies (CEIT), Graduate School of Natural and Applied Science . All the students took courses on distant education and teaching technologies. The reason for selecting CEIT students was that they were familiar with information and communication technologies, furthermore. They had knowledge of, and experience in distant education and teaching technologies.

Data Collection Tools

To determine the views of the students about the developed mobile learning environment, a semi-structured interview method was used. The interview method involves oral communication with the participants to determine their views on a certain subject with their reasons (Çepni, 2007 p. 107). During the application of the environment, to determine the delay in audio and video, the EDGE and wireless internet communication technologies were separately measured. The measurements indicated the duration of transfer of audio and display by the mobile devices.

Development of the Environment

While developing the environment, Adobe Flash CS4, Adobe Flash Media Server 3, Adobe Flash Media Live Encoder, Apache Server, PHP and MySQL software were used. To view the environment appropriately with mobile devices, the environment was designed in 2 different resolutions (240 x 320 and 240x400 pixels). Screen resolution of mobile devices and appropriate display transfer were paid attention. Mobile devices were selected according to the criteria of having Flash support, internet connection and reasonable activation of the prepared application. During the development stage of the application, the Adobe Flash Lite 3.1 platform, Action Script 2.0 code structure were used. In the study 2 Samsung i900 omnia and 2 Toshiba Portege G500 mobile phones were used. To achieve the best sound transfer from these devices, 4 earphones were used.

The users were allowed to log in to the environment after activating user entrance. The environment contained 3 different sections. These included a live display screen where simultaneous display is transferred (Figure-1); the video monitor where recorded courses can be viewed in the server (Figure-1) and the chat monitor where the users messages to each other and the questions they asked the teacher were displayed

(Figure-2). To achieve the live display transfer, a display and audio source needs to be streamed. This audio and display source was transferred by the teacher using technologies such as a web camera, microphone and teleconferencing device. In the prepared environment, this audio and display source was streamed from the internet environment using Flash Media Server 3. The streamed display and audio data can be obtained by mobile devices using 2 different types of communication, EDGE and wireless network technologies. Since the highest bandwidth of EDGE data communication technology in Turkey is 128 kbps, the display and audio to be streamed over the internet must have a smaller bandwidth.

To comply with the bandwidth restrictions and to achieve a better data transfer, using Adobe Flash Media Live Encoder program, display and audio were reduced to 98 kbps bandwidth. With the purpose of processing the audio properly in the test device, to process the audio as mono and to access the application from the display, it was transferred from Adobe Flash Media Server 3 program as a stream. In the live broadcast monitor, when the user presses the start button, the application will direct the data to the server uploaded with Adobe Flash Media Server 3, will access to the stream transferred from this server and is presented to the user. There was a menu on video screen, where the user could select any course they wished to watch.

Figure: 1
Live display screen presents the simultaneous display and the
video screen where courses recorded in the server can be watched.

When a course was selected and start button was pressed the video was transferred from the file server and can be immediately watched. With this method, the student had the opportunity of watching pre-recorded courses anywhere, anytime. In development of the chat section, Apache Server, PHP and MySQL software were used. The messages sent by the users were kept in the MySQL database on a web server and transferred to the application via PHP program.

Figure: 2
Chat screen where the students can talk to
each other and ask the teacher questions.

Realization of the Application

The environment was applied to the students during a teleconference session in KTU, Distance Education Center, Fatih Studios. During the teleconference, video and audio were streamed via the Adobe Flash Media Live Encoder 3 program. Using appropriate mobile devices, with the prepared program, the students simultaneously reached display and audio streamed over the internet. The students realized the application in turns, in two groups of 4. Each group of 4 students watched teleconference application unidirectionally from their mobile devices for 30 minutes. In order to compare the different technologies, internet Access for 4 students was provided over the mobile phone network with the EDGE technology, for the other 4 students access was provided by a wireless internet connection.

Analysis of Interview Data

Data obtained from semi-structured interviews was subjected to a descriptive content analysis and the interview data was electronically transcribed by the researcher. The data was converted into a transcript, each interview was reviewed and the themes were formed to be presented here.

FINDINGS

The findings obtained from the application realized with a mobile environment indicated that while the audio and display delay in the mobile phones reaching streamed display using EDGE technology varied between 4-5 seconds; audio and display delay in mobile phones with wireless internet connection varied between 7-8 seconds. The participants were asked to compare conventional education environments and the courses in which mobile devices were used. They were also asked to list the advantages and

disadvantages of conducting courses with these mobile devices. Based on the data obtained within this framework, "Time, space, socialization, interaction, teaching, repeatability, access to a large mass of people, themes were formed. In terms of the time theme, the participants reported that the utilization of mobile devices in teaching could offer flexibility to the individuals to receive education whenever they want. In this framework, the views of one of the participants were as follows:

> *"Today, time is the most precious thing for human beings. As these systems save from time, they are functional systems. The people can connect to the system from anywhere, whenever they want..."*

The participants discussed contributions of mobile devices in teaching environments. They reported that, if an individual in an education environment is absent for any reason, the individual can compensate for this situation with mobile devices.

> The following statement supports this view: "First of all, there is no spatial dependency. The students or users can access to the system anywhere"

In addition to the advantages the participants reported some disadvantages of the system, which are generally focus on socialization and interaction themes. Based on the view that utilization of mobile devices will negatively effect social development, the views of one of the participants were as follows:

> *"Mobile devices offer a technology that eliminates the problems of being late for class or compensation for absence in the course in conventional education However, the utilization of these systems in all courses and applications decreases socialization."*

Another point was about interaction factor was reported by another participant in that "this program lacks the interaction in face-to-face education (student-teacher)."

As for the teaching, repeatability and access to large masses of people, the advantages of the utilization of mobile themes in education were discussed. It was reported that mobile learning would contribute to life-long learning. Stating that the individuals have the opportunity of repeating these educations as much as they want, the participants emphasized the theme of repeatability.

In addition, along with the utilization of mobile devices in the teaching environment, large masses of people can be accessed in a shorter time. The view of one of the participants was as follows:

> *"It is possible to connect to the courses from different environments, individuals with different student profiles can be contacted."*

When the participants were asked to compared the teleconference system and the mobile system, the views of the participants under the space theme indicated that mobile system offered broader alternatives than teleconferencing in terms of space. In this case, the participants considered mobile learning was one-step more advanced than teleconferencing. However, under the theme of focusing, considering that mobile devices can sometimes cause motivation problems when compared to teleconference system, one of the participants reported that the " narrow attention area in mobile systems is a disadvantage".

The descriptive analysis of the participants on the feasibility of the mobile learning system indicated that their views concentrated on "system performance, system design, need, cost and technical infrastructure" themes. For the most effective operation and problem-free education, the participants focused on operation performance of the

system and technical infrastructure. In this context, the views of the participants were as follows:

> *"First of all, we can improve these systems by eliminating display and audio delays. Simultaneous display and audio can make the course more understandable."*
> *"When mobile education is going to be applied, the technological infrastructure should be well-established. Otherwise, the deficiencies of the system will distract the students. So the infrastructure should be strong."*

In addition to the system performance and the technical infrastructure, the design of the developed system was also discussed in terms of practicality. The views of the participants about system design were as follows:

> *"We were unable to hear the voices of the people who asked the teachers questions during the class. I think this is one of the most important problems to be eliminated."*

The participants also considered the cost of utilizing mobile devices in education. The view of one of the participants about the development and utilization of these kinds of systems were as follows:

> *"There are some requirements for using this mobile system. The mobile phones equipped with these technologies are expensive."*

Another point considered by the participants under the title of the feasibility of mobile systems in teaching environments was about the needs of people for such a way of teaching. In this context, the views of the participants about the "need" theme were collected one of the participants commented:

> *"The mobile system can serve as a life buoy. It can be beneficial in case of missing a meeting due to some obligations."*
> *When the views of the participants were analyzed in terms of making the developed mobile system widespread, the themes of "technical infrastructure cost, information, qualified human resources and utilization area" were formed. Under the theme of technical infrastructure, the participants emphasized the importance of technical devices in relation to the utilization of mobile systems. At this point, another issue was raised concerning the cost required for providing the technical infrastructure. The views of the participants about this issue were as follows: "I believe that this system can be widespread when it starts with simple applications and it is supported with a well-established technologic infrastructure."*
> *"This system can be made widespread. The only condition is the availability of tools and devices for supporting this technology. In short, it is expensive."*

The participants reported that for making this system widespread, users should have a certain degree of technological literacy. They further mentioned about the need for qualified human resources to develop this system. The views about information and qualified personnel were as follows:

> *"The system can be made widespread. However, particularly the need for qualified personnel should be accommodated."*
> *"...It is important to provide brief information about the properties of the system in the entry to and exit from the system."*

> *"A short informative course should be provided for the utilization of this system, because everyone is not familiar with the same level of technology."*
> *To make the developed mobile system widespread, the participants considered that it would be more appropriate to use these systems when they are particularly needed by the individuals. In this context, the views of one of the participants were as follows:*
> *"This system can be particularly beneficial in post-graduate courses. Furthermore, it can be used and made widespread and used in training such as in-service education-company courses."*

The views of the students indicated that the duration of course sessions should be maximum 20-25 minutes. The views of one of the participants about this issue were as follows:

> *"...with this system a course can be followed for a duration of 15-20 minutes."*

RESULT and DISCUSSION

The findings based on the views of the participants indicated that, when mobile learning and conventional education environments were compared, mobile learning does have a role to help the students overcome the problems they experience in attending education-learning activities due to time and space constraints in conventional education.

The main problems experienced in distance education were socialization and interaction factors (Usun, 2006, p. 20). In addition, another restriction of distance education was the lack of face-to-face education opportunities (Isman, 2008, p.19). The findings based on the views of the participants supported this view. In this context, factors such as socialization, lack of face-to-face education and interaction restrictions were reported related to the developed mobile learning environment. However, instead of completely transferring a course to this environment, mobile learning applications should be considered as supporting the courses. Mobile learning will contribute to a more qualified conventional education (Georgiev, Georgieva & Smrikarov, 2004).

Based on the views of the participants, it was concluded that mobile learning environments would contribute to the life-long learning of the individuals, it will offer the users the opportunity of watching course content again and again and will offer more students the opportunity of participating to education-learning activities. Kaya (2002, p.21) reported that distance education had a positive effect on facilitating mass education. Mobile environments will offer new life-long learning opportunities to the individuals who were unable to continue education-teaching for various reasons or for the individuals who want to improve themselves in a certain subject. Similarly, Oran and Karadeniz (2007) reported that mobile learning can provide a flexible environment and life-long learning how can you save time in life long learning? (Oran ve Karadeniz, 2007). With the developed mobile learning environment, the facility for students to repeat their viewing of the content supports the fact that individual's learn at different speeds.

In distance education, teleconferencing applications are a way to overcome the problems that exist in face-to-face education. Although the participants do not share the same physical space, via the reciprocal instant audio and display transfer, they have the opportunity of sharing their emotions and opinions. However, the cost of installing teleconferencing systems is high. Web conferencing and live web broadcasting applications also offer individuals the opportunity of sharing emotions and opinions. Although these opportunities are presented in web environment, the individuals need a computer and an internet connection, which restricts spatial independence. With the developed mobile learning program, even if an internet connection is not available, the

individuals have the opportunity to access display and audio in a teleconference application from anywhere with a mobile phone network.

The views of the participants support this statement, suggesting that the developed mobile learning environment would increase spatial independence. However, the participants also reported that the students could experience problems in focusing on the mobile learning environment. This limitation is thought to be related to the low screen resolution and narrow bandwidth.

The synchronization measurements of the developed mobile learning environment indicated that, with this environment unidirectional simultaneous applications can be realized in distance education environments. However, the findings obtained from the measurements and participants' views indicated that the environment should be developed in terms of synchronization. The fact that the applications using wireless connections were found to be slower than EDGE applications indicated that in this environment EDGE technology would be more beneficial for internet access. Turkey recently began to use 3G technology and speed limitations are thought to have been eliminated after the increase in bandwidth. This might also eliminate the synchronization problem of the environment. For the utilization of the developed mobile learning environment the fact that the cost of mobile devices and mobile phone network are high. Another problem in these kinds of new environments involves possible problems in technical infrastructure; however, these could be eliminated by widespread use of mobile technologies and similar applications. The participants reported that the environment should be designed to allow for teacher-student and student-student interaction. In this context, it is important to design the learning environment in such a way to allow for two-directional communication. Another limitation of the environment was that the voices of the participants in the teleconference session other than the teacher who undertakes presentation could not be heard in the mobile environment. To overcome this problem, the audio transfer of the system should be enhanced in such a way to include all users. It was found that to make similar mobile learning environments widespread, there is a need for qualified human resources and for the individuals to be able to effectively use mobile devices and technologies. In this context, the individuals should be informed about the opportunities which can be made available through the use of mobile communication Technologies and mobile learning environments. In conclusion, the participants reported that sessions should not exceed 20 minutes in these kinds of applications in mobile learning environment. Trifonova and Ronchetti (2003) reported that session value of a module should be short and should not exceed 10-15 minutes in mobile learning environments (Trifonova & Ronchetti, 2003).

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