THE USE OF MOBILE TECHNOLOGIES IN MULTIMEDIA-SUPPORTED LEARNING ENVIRONMENTS

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ABSTRACT

The aim of the study is to reveal the students' opinions about the use of PDAs (Personal Digital Assistant) in learning environment within the context of multimedia based applications. Through purposeful sampling, 17 undergraduate students attending the elective course of BTÖ 323 Character Design in Computer Environment in the Department of Computer Education and Instructional Technology at Anadolu University were involved in the study.

Additionally, the present study was conducted in two phases; in the first phase, within the scope of the course, an interactive Learning content including the subject of "Interactive Multimedia Design" was prepared and installed on PDAs. Then, the PDAs installed with these prepared contents were distributed to the students, and two-hour training on how to use the PDAs was given to the students. In the second phase of the study, a three-week application regarding students' following the course content via PDAs was conducted. Throughout the application, the students communicated with the instructor for extracurricular feedback by means of PDAs. After the application, semi-structured interviews were held with the students regarding the course application performed via PDAs and its effectiveness.

The interview data collected were examined with descriptive analysis. The results demonstrated that most of the students explained the hardware inadequacies in the use of multimedia environment facilities via PDAs such as visual images, videos, animation particularly in learning content.

Besides this, for the interactive dimension and communication, the students mentioned negativities particularly regarding file sharing. Consequently, it was concluded that the students had negative opinions about the presentation of multimedia-supported Learning content via PDAs.

Keywords: mobile learning, multimedia, multimedia and mobile learning

INTRODUCTION

Technological developments influence every field of educational environments. With recent developments in technology, it has been understood that educational environments are not limited to schools and related institutions.

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With the use of computers and the Internet in educational environments, opportunities to access information have changed, and such concepts as e-learning and m-learning have occurred. In recent years, mobile learning (m-learning) has been a crucial component of e-learning.

Although related to e-learning m-learning focuses on the mobility of the learner. Mobile learning is a kind of learning that offered by mobile devices and which offers to learners independent of the time and place. According to Traxler (2009), m-learning (mobile learning) is defined as instruction given in environments supported with such mobile technologies as smart phones, hand-held computers (PDAs) and laptop computers or supported. Pieri and Diamantini (2009) define mobile learning as the presentation of any instructional content to certain target populations via portable tools such as hand-held computers, laptop computers, e-books and mobile phones. According to Quinn (2000), mobile learning is an e-learning activity carried out with the help of such portable electronic tools capable of doing numerical calculations as hand-held computers and mobile phones. Smart phones, hand-held computers (PDAs), portable DVD players, MP3-MP4 players and notebook computers can all be considered as mobile technology tools. As the common features of these tools, they are light, and they allow users to interact with the non-verbal and visual stimulants of multimedia thanks to their rechargeable batteries.

The developing technology has made computers evolved in time in that many of their features have been improved and they have become smaller in size. With the developing technology, desktop computers big in size have been replaced by laptop computers smaller in size, which have now been replaced by hand-held computers (PDA-Personal Digital Assistant) that can be put into a pocket. PDAs can be defined as hand-held computers which allow mobile communication and access to the Internet as well as which can process, organize and store non-verbal materials such as written and musical texts as well as visual and audio narrations such as pictures, animations and video records in multimedia environments. Since PDAs also allow faster access to the Internet with the help of 3G technology, since they are portable and since they have good technical features, PDAs have an important place in mobile learning.

PDAs use operating systems of PalmOs, Symbian and Windows. In addition, these devices also include programs that allow opening multimedia files such as videos, pictures and audios, surfing on the Web, preparing tables and doing calculations. Because these devices support such software development programs as Java, XML and Flash and because they allow transferring data to PCs, they facilitate designing educational software for personal computers. Mitchell & Doherty (2003) stated the advantages of PDAs as high speed of data transfer, independence of time and place for Web access, data storage in their own memory, ability to connect to computers, and ability to open pictures, videos and animations in different formats. In addition to these advantages, PDAs are light and small, which makes it portable.

Georgiev, Georgieva and Smrikarov (2004) emphasized certain disadvantages of PDAs stating that:

1. Due to their physical dimensions, the amount of information to be shown on the small screens of PDAs is limited.
2. The small keypads of PDAs make data input difficult for users.
3. PDAs have limited capacity of memory.
4. It is necessary to charge the batteries of PDAs regularly. In addition, their batteries have certain length of life.
5. Software developed for computers cannot be directly used in PDAs.

6. Due to their slow access to the Internet, it is difficult to open videos and high-resolution images via the Internet by using PDAs.
7. Some users are likely to find the cost of wireless Internet connection high.

Furthermore, the prices of PDAs are higher than those of desktop computers. However, they have similar or lower prices when compared to those of laptop computers.

Purpose of the Study

The overall purpose of the present study was to determine students' views about the use of PDAs (personal digital assistant) within the context of multimedia-based applications. In line with this basic goal, the present study seeks answers to the following research question: 'What are students' views about the use of PDAs in the multimedia-based educational processes.'

METHOD

In this study, which aimed at determining students' views about the use of PDAs (personal digital assistant) in educational settings within the context of multimedia-based applications, the qualitative research method was applied for the collection, analysis and interpretation of the research data.

Participants

In order to determine the students with whom the present study was carried out, criterion sampling, one of the purposeful sampling methods, was used. In the present study, which tried to determine students' views about the use of PDAs in educational settings within the context of multimedia-based applications, the students taking a course in which multimedia applications were effectively used, were taken as the basic criterion in the study.

In this respect, the optional course of BTO 323 Character Design executed by one of the researchers in the Department of Computer Education and Instructional Technologies in the Education Faculty of Anadolu University and the content of this course were examined, and it was revealed that the study met the criterion that multimedia facilities were used effectively in the course. A total of 17 undergraduate students taking this course constituted the research sample.

Data Collection

The research data were collected via interview forms including 6 open-ended questions which were based on instructional content presented in a period of 7 weeks and conducted based on an instructional content presented via PDAs and developed within the scope of this study. In this respect, first, a content to be presented via PDAs was developed (See Picture: 1). Within the scope of the study, in the course of BTO 323 Character Design previously determined, the subjects of 'Design Elements and Design Principles in Character Design' were developed as appropriate to the multimedia facilities as well as the screen design of PDAs in a way to be presented via PDAs in a period of four weeks. In the content presented via PDAs, certain interactive presentations, examples, videos and applications that could be beneficial for the design process, and the students were asked to develop a project based on the educational content given via PDAs at the end of the process and were asked communicate the feedback regarding the project with the faculty member via PDAs.

Within the scope of the study, the instructional content was presented in a period of four weeks, and the interactions to be conducted in the process of project development were carried out in a period of 3 weeks; in addition, the project developed was regarded as an end-of-term study.

The content presented via PDAs was prepared with the programs of Adobe Photoshop, Adobe Flash CS3 and Adobe Flash Lite. The contents prepared were installed on PDAs, checked by the researchers and made ready for students' use. As a result, the contents prepared were distributed to 17 students found in the research sample.

Picture: 1
Screen Images of Multimedia-Based Instructional Content Presented via PDAs

Prior to the application, the students were introduced to the features of PDAs in 4 course hours -45 minutes each- regarding the use of features as images, visuals, interactive media designs and videos that could be considered as multimedia facilities; regarding the use of interaction facilities that provide student-faculty member and student-student interactions; and regarding the follow-up of the instructional content.

During the process, the students established direct communication with the faculty member, received feedback regarding their designs, and shared files with the faculty member by uploading them.

The students were asked to reflect their acquisitions on the design development process within the scope of all these interaction facilities. In the study, the subjects determined as 'Design Elements and Design Principles Character Design' in the course of BTO 323 Character Design were presented to the students in a period of 4 weeks. Regarding the dimensions of access to the subjects and interaction with the faculty member, there was no limitation for the students; thus, the students themselves determined these periods in line with their own needs.

Following the presentation of the instructional content, the student-faculty member interaction, feedback regarding the design development and application and the evaluation activities were carried out in a period of 3 weeks via PDAs in the project development process based on the instructional content.

In the interview form applied to determine students' views following the application process, the students were asked to report their positive or negative views about the use of PDAs in the lessons. Within the scope of the presentation and use of the instructional content via PDAs, the students were asked to state what types of problems they experienced and what type of opportunities they had regarding especially interactive applications.

The students were required to evaluate PDA with respect to its contribution to the lessons. Within the scope of the study, they were asked to investigate the effective usability of PDAs especially regarding the applications requiring interaction and regarding the use and design of multimedia opportunities.

Data Analysis and Interpretation

For the analysis of the data obtained in the study, descriptive analysis was applied. In this respect, in line with the research questions and the conceptual framework of the study, the research data were analyzed based on the interview forms of the students.

In the second phase, the findings obtained were presented as frequency distributions, and the written texts and pictures of the students were interpreted.

In the process of the analysis of the research data, first, a framework was prepared in line with the research questions and the conceptual dimension of the study, and in line with this framework, the researchers determined the themes under which they organized and presented the data.

In the study, the data were chosen for description and gathered in a meaningful and reasonable way. Following this, the data organized were defined and presented with the support of direct quotations when necessary.

In the phase of explaining, relating and giving meaning to the findings, for better-quality interpretation made by the researcher; the reason-result relationships between the findings were revealed, and the research findings obtained were compared with those of other studies (Yıldırım and Simşek, 2005).

In the phase of data analysis, for the data obtained from the students based on the interview forms, a form including the parts of descriptive index and researcher's comment was prepared.

These parts included in the form were filled out by the researchers.

For the reliability of the study, the researchers and field experts examined the forms and determined the items that they agreed and disagreed on.

For the calculation of the reliability of the study, the reliability formula suggested by Miles and Huberman (1994) was used. As a result of the calculations, the reliability of the study was found as 98%.

FINDINGS AND INTERPRETATIONS

The findings obtained in the study and gathered under four main themes such as '*Access to instructional content*', '*Use of multimedia-based instructional content*', '*Technical features*' and '*Communication and interaction features*' were tabulated in

Table 1 as frequency distributions and summarized with the support of direct quotations from the views of the participants in the study.

Table: 1
The students' opinions about the use of

Themes	f
Access to the instructional content	*19*
• Effective and rapid access to the instructional content	14
• Limited access to the instructional content	5
Use of the multimedia-based instructional content	*27*
• Effective use of multimedia contents is easy	5
• Effective use of multimedia contents is difficult	18
• Effective use of the instructional content is easy	3
• Effective use of the instructional content is difficult	1
Technical features	*50*
• PDA technology is sufficient	4
• PDA technology is not sufficient	2
• Equipment features are sufficient	10
• Equipment features are not sufficient	34
Communication and interaction features	*50*
• Use of communication tools is sufficient	21
• Use of communication tools is not sufficient	24
• Opportunities for establishing interaction is sufficient	3
• Opportunities for establishing interaction is not sufficient	2
Total	17

PDAs in multimedia based learning environments.

Within the scope of the main theme of "*Access to the instructional content'*, the sub-theme of '*Effective and rapid access to the instructional content'* is obviously striking. The sub-theme of '*Effective and rapid access to the instructional content'* was explained by the participants with respect to certain positive sides.

These positive sides were as follows: '*Independence of time and place in accessing the instruction', 'Easy access to the necessary information with the menus and directives in the instructional content', 'Easily receiving feedback', 'Easy interaction with the teacher', and 'Easy share of data'*

The fact that the PDAs used in the application was a portable device might have caused the students to state positive views about the fact that they accessed the instructional material, that they shared information, and that they received feedback by interacting with their teachers. The reason is that the PDA device, with its features, makes learning independent of time and place. Regarding this point, one of the students, 'A3', stated *"the biggest benefit of PDAs is that you can communicate with the teacher at any time all day. You receive feedback more quickly. And also learning occurs independent of time and place ...".*

Besides the positive views of the students, they also reported views about the limitations created by limited access based on the main theme of,

'*Access to the instructional content' and mentioned some problems regarding 'Ineffective use of the menus and the directives in the instruction content' and 'Small dimensions of the menus and directives for effective use'.*

The students' views revealed that the menus and directives that allowed access to the necessary information in the content were too small for effective use, which thus made the use of PDAs difficult. Regarding this point, one of the students, 'A7', stated '*If some of the menu buttons used in the PDA were bigger, it would be better for easy use and recognition".*

In the application process, in line with the students' views, the sizes of the verbal (texts) and visual stimulants (pictures) of the material presented via PDA could be said to be the factors that determine the effectiveness of the presentation of the instructional content. The reason is that regarding the inefficiency of these features, the users experienced problems in examining the visual and verbal information in the instructional content presented. 'A6', one of the students, stated *"The font size was small. The pictures are small. And the resolution of the pictures was very low."*

In addition, regarding the inability to play the audio from the instructional material, the participants stated '*the unity of the instructional material was disrupted".* Regarding this point, one of the students, 'A1', stated *"The Media Player opens in a separate window for the audio parts. I just want to listen to sounds within the material. In this respect, Media Player disrupts the wholeness".*

In the study, it was found out that within the scope of the main theme of '*Use of multimedia-based instructional content',* a very few number of students reported positive views about the sub-themes of '*Effective use of multimedia contents is easy'* and '*Effective use of instructional material is easy'.* On the other hand, most of the students mentioned problems regarding the sub-themes of,

> '*Effective use of multimedia contents is difficult'* and '*Effective use of instructional content is difficult'.* According to the students, in general, these problems were '*Multimedia contents are not presented effectively via PDA', 'Font size is small', 'Visuals are small', 'Visuals are not clear', 'Audio is played out of the material and disrupts the wholeness of the material'* and '*Videos are played out of the material and disrupts the wholeness of the material'.*

A majority of the students experienced problems with the technical features of PDAs. These technical problems were mostly related to deadlock, sim-card connection, duration of charge, the weight of PDA, useless menus, small screen and insufficient key-pad and touch-pad screen features.

The students reported few positive views about the technical use features of PDAs. The theme that the students mentioned most was "*Technical features".*

The students reported that in the application process, technical features directly influenced especially the presentation of multimedia contents. The reason is that with respect to technical features, there were several limitations regarding accessing multimedia contents, running the contents (audio, animation and video file formats), surfing between and downloading contents and applying the visual and functional features of contents (due to not big enough screens).

All of the students reported at least one negative view about the equipment features of PDAs. Regarding the insufficient equipment features of PDAs, 'A5', one of the students, stated "*Its charge was not long. It is big and heavy.* Since it includes rich content, its touch-pad feature is not useful.

> *The photos you take with PDA are bad. Its normal keys are too close to each other and are not useful. It has some problems with the use of sim-card... its battery gets too hot."*

The students also mentioned the positive sides of PDAs as well as its insufficiencies and equipment features.

One of the students, 'A7', stated *"the charge duration of a PDA is quite enough for simple applications and you can quickly charge it; however, the more complex the application, shorter the charge duration of the battery. Its tools are useful; like connecting it to a computer, charging its battery and using its headphones...".*

In this respect, it was seen that the students focused more on the equipment features of PDAs than on their technological capabilities. As for the technological capabilities of PDAs, one of the students, 'A3', stated

> *"...the slowdown and deadlock that occur while using the PDA make me unwilling to use this device... If this study were carried out with more up-to-date PDAs, better results could be obtained".*

With respect to another main theme, "*Communication and interaction features",* the students reported views mostly about the sub-themes of *"Use of communication tools is sufficient"* and *"Use of communication tools is not sufficient".* It was seen that the number of students' positive views about the use of communication tools of PDAs was similar to that of their negative views about the use of these tools. Regarding the capabilities and insufficiencies of PDAs with respect to their communication tools, one of the students, 'A17', stated *"with PDA, one can receive feedback regarding the projects related to this lesson. Discussions can be made with friends regarding the projects. E-mail can easily be used about the lesson subjects. With respect to receiving feedback, the file size can lead to a problem. Sending an e-mail without using the 3G technology can be a problem in areas with wireless connection."*

In addition, under the main theme of *"Communication and interaction features",* the number of the students' views about the sub-themes of *"Their capability of establishing interaction is sufficient"* was similar to the number of their views about the sub-theme of *"Their capability of establishing interaction is not sufficient"* Regarding this point, one of the students, 'A9', stated *"Its features that allow establishing interaction between the applications and the user are not very good",* while another student, 'A4', stated *"There was a great deal of interaction, so I didn't have any difficulty understanding the content".* In general, the students reported negative views about the presentation of multimedia-based instructional environments via PDAs; however, they stated that with the use of a well-equipped device, applications like this could be more effective.

CONCLUSION AND SUGGESTIONS

In this study, which aimed at determining the students' views about the use of PDAs (personal digital assistant) in educational environments within the scope of multimedia-based applications, a majority of the students generally mentioned the equipment insufficiencies of PDAs regarding the presentation of multimedia facilities such as visual images, videos and animations found especially in the multimedia-based instructional content. Regarding the communication and interaction dimension, the students mentioned especially the difficulties they experienced in file sharing.

Within the scope of the study, it was concluded that the students had negative views about the use of PDAs in presenting the multimedia-based instructional content.

Based on the findings obtained in the study and gathered under four main themes such as 'Access to the instructional content', 'Use of multimedia-based instructional content', 'Technical features' and 'Communication and interaction features', it was seen that the students mostly mentioned negative sides of PDAs.

The students experienced a number of problems especially with access to the multimedia-based instructional content via PDAs, with the use of the content and with technical features. In order to provide effective multimedia-based instruction via PDAs, PDAs should have better equipment and interaction features.

The students' positive views about the communication and interaction features of PDAs were parallel to their negative views about the same point yet clearly differed with respect to the other dimensions. In other words, it could be stated that the students found PDAs more effective with respect to the interaction and communication they established with the faculty members in the instructional environment when compared to the other dimensions.

However, these features were not found sufficiently effective. The basic reason for this was the insufficiency of the PDA technology used in the study. The students mentioned various problems related to deadlock, duration of charge, taking photos, uploading files and phone features and other equipment-related problems.

While accessing the instructional content independently of time and place was a positive side of PDAs, the technical problems experienced in accessing the instructional content influenced the students' views about this feature. The difficulties in accessing the instructional content also influence the use of multimedia-based software, and the students thus reported negative views about this subject. In their study on mobile technologies in Internet-based instruction, Oran and Karadeniz (2007) found out that mobile technologies enable students to study at any time and in any place they want.

This finding reported by the researchers is parallel to the positive views reported in the present study about accessing the instructional content independently of time and place.

The problems experienced in accessing the multimedia content via PDAs were basically regarded as the result of various technical insufficiencies such as the useless menus, small screens, low screen resolution, insufficient file uploading, insufficient memory card and inappropriate key-pad.

The problems regarding the presentation and use of multimedia facilities via PDAs were thought to result from small typographic elements, small visuals, ineffective uploading of audios and videos and the problems with data sharing. The research results differed from those of other studies reported in related literature on the effective use of PDAs in instructional environments (Kenny et. al., 2009; Kuzu, Çuhadar and Akbulut, 2007; Allan, Carbonaro and Buck, 2006; Mutlu, Yenigün and Uslu, 2006).

The reason for this could be the fact that within the scope of the study, the PDAs had many multimedia features yet the qualities of PDAs were not sufficient. In addition, the results of the studies mentioned above were also parallel to the students' views reported in the present study about the fact that if the qualities of the PDA technology were different, there would be better instructional opportunities.

As a result, especially for the presentation of multimedia applications, PDAs are regarded as effective depending on their qualities. The sufficiency of the qualities of PDAs will place these devices among the technologies that contribute to the educational processes especially regarding the presentation of the instructional content via these devices, access to the instructional content, independence of time and place and effective communication with the faculty member.

REFERENCES

Akova, O. (2000). *Cognitive ergonomics and the importance in the information society*. Ankara: Kara Harp Okulu. Bilgi Toplama Ve Yayım Merkezi Yayınları.

Allan, C., Carbonaro, M. & Buck, G. (2006). A survey of personal digital assistants (PDAs) use in a middle school environment: Perceptions of teachers, parents and students. *Meridian Middle School Computer Technologies Journal, 2*(9). Retrieved January 13, 2010 from http://www.ncsu.edu/meridian/sum2006/PDAS/

Bennett, C. (2002). *Changing education ergonomics*. The proceeding of XVI Annual International Occupational Ergonomics and Safety Conference, http://www.iea.cc/ergonomics4children/pdfs/ChangingEducationErgonomics_Bennett.pdf Retrieved January 10, 2009,

Georgiev, T., Georgieva, E. & Smrikarov, A. (2004). *M-learning – a new stage of e-learning*. Retrieved January 9, 2010 from http://ecet.ecs.ru.acad.bg/cst04/Docs/sIV/428.pdf

Kenny, R., Park, C., Van Nestle-Kenny, J., M., C, Burton, P., A. & Meiers, J. (2009). Using mobile learning to enhance the quality of nursing practice. M. Ally, (Ed.), *Mobile learning: Transforming the delivery of education and training* (75-98). Edmonton: Athabasca University Press.

Kuzu, A., Çuhadar, C. & Akbulut, Y. (2007). *Reflections of undergraduate students regarding Pda use for instructional purposes.* Retrieved January 5, 201 from http://www.sosyalbil.selcuk.edu.tr:8080/651/1/reflections .pdf

Kılıçer, K., Çoklar, A., N. & Odabaşı, F. (2007). *Designing technology-based multimedia applications: Cognitive ergonomics.* VII. International Educational Technology Conference Proocedings, Nicosia, KKTC, 3-5 May.

Mitchell, A. & Doherty, M. (2003). *M-learning support for disadvantaged young adults*. Retrieved January 9, 2010 from http://www.m-learning.org/archive/docs/Cal03%20paper%20Ultralab%20Apr%2003.pdf

Mutlu, M., E., Yenigün, U. & Uslu, N. (2006). Mobile learning in Open Education: Evaluation of the use of open education e-learning facilities via mobile communication devices. *Akademik Bilişim 2006,* Pamukkale University, Denizli.

Opperman, R. (2001). *User interface design.* Retrieved January 5, 2010, from http://fit.fraunhofer.de/~oppi/publications/UserInterfaceLearningSystems.pdf

Oran, M. K. & Karadeniz, Ş. (2007). The role of mobile learning in Internet-based distant education. *Akademik Bilişim 2007,* Dumlupınar University, Kütahya.

Pieri, M. & Diamantini, D. (2009). From e-learning to mobile learning: New opportunities. M. Ally, (Ed.), *Mobile learning: Transforming the delivery of education and training* (183-194). Edmonton: Athabasca University Press.

Quinn, C. (2000). M-Learning*: Mobile, wireless, in-your-pocket learning.* Retrieved January 9, 2010from http://www.linezine.com/2.1/features/cqmmwiyp.htm

Traxler, J. (2009). Current state of mobile learning. M. Ally, (Ed.), *Mobile learning: Transforming the delivery of education and training* (9-24). Edmonton: Athabasca University Press.

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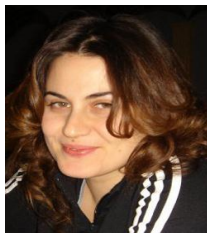
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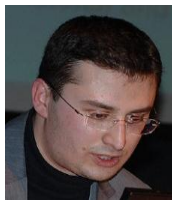
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