T.C.

BAHÇEŞEHİR ÜNİVERSİTESİ

E-COURSE DEVELOPMENT FOR IPHONE APPLICATON PLATFORM

Master's Thesis

Metin YENİDOĞAN

İstanbul, 2010

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Asst. Prof. Dr. Tunç BOZBURA
Director

This is to certify that we have read this thesis and that we find it fully adequate in scope, quality and content, as a thesis for the degree of Master of Science.

Examining Committee Members:	Signature
Assoc. Prof. Dr. Adem KARAHOCA:	_____
Asst. Prof. Dr. Alper TUNGA:	_____
Asst. Prof. Dr. Yalçın ÇEKİÇ:	_____

To my loved ones…

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ABSTRACT

E-COURSE DEVELOPMENT FOR IPHONE APPLICATION PLATFORM

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Recently, the term "mobility" has started to take an important place in our lives due to the rapid improvements in technology. Mobile devices such as cell phones, laptops, tablet PCs, PDAs and smart phones have already become indispensable in our daily lives. These devices' biggest advantage over PCs is that they are small enough to fit in out pockets.

In their first years, mobile phones were just devices used for communicating with voice and nothing else. Parallel to the improvement of the technology, they are now able to do everything a standard PC can do. Connecting to the Internet, running multimedia applications, taking photos, listening to the music, preparing Office documents are just a few. New advances in hardware and software are making mobile "smart phones" indispensible tools.

We are aiming to combine new generation smartphones, also known as iPhones, and e-course terminologies and form a new world for the students with this thesis. No doubts that if mobile learning (m-learning) works, it can potentially reach millions of people, who have difficulties to get access to learning materials, otherwise.

Keywords: Mobile Learning (m-learning), Smart Phones, iPhone

ÖZET

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Teknolojideki hızlı gelişim sebebiyle, son zamanlarda "taşınabilirlik" terimi hayatımızda önemli yer tutmaya başlamıştır. Cep telefonları, dizüstü bilgisayarlar, tablet bilgisayarlar, cep bilgisayarları, ve akıllı telefonlar gibi taşınabilir aygıtlar şimdiden günlük yaşamımızın vazgeçilmezi olmuştur. Bu aygıtların kişisel bilgisayarlara göre en büyük avantajı cebimize sığacak kadar küçük olmalarıdır.

İlk çıktığı yıllarda, taşınabilir telefonlar sadeec sesle iletişim kurmamıza yarayan aygıtlardı. Teknolojinin gelişmesine paralel olarak, şimdilerde standart bir bilgisayarın yaptığı hemen her işi yapabilmektedirler. İnternete bağlanmak, multimedya uygulamaları çalıştırmak, fotoğraf çekmek, müzik dinlemek, Office dökümanları hazırlamak bu işlerden sadece birkaçıdır. Donanım ve yazılımdaki yeni gelişmeler, taşınabilir "akıllı telefonlar"ı vazgeçilmez eşyalar haline getirmektedirler.

Bu çalışmadaki amaç yeni jenerasyon akıllı telefonları, iPhone olarak da bilinir, e-ders terimiyle birleştirmek ve öğrenciler için yeni bir dünya yaratmaktır. Hiç şüphe yoktur ki taşınabilir öğrenim uygulamaya geçildiğinde, potansiyel olarak öğrenim materyallerine ulaşmakta zorluk çeken milyonlarca insana ulaşabilecektir.

Anahtar Kelimeler: Mobil Öğrenme, Akıllı Telefonlar, iPhone

TABLE OF CONTENTS

vi

LIST OF TABLES

LIST OF FIGURES

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LIST OF ABBREVIATIONS

Personal Digital Assistant   : PDA

Electronic Learning   : E-Learning

Mobile Learning   : M-Learning

World Wide Web   : WWW

World Wide Web Consortium   : W3C

Operating System   : OS

iPhone Operating System   : IOS

1. INTRODUCTION

The literature has provided many labels out of classroom learning – distance learning, distributed learning, correspondence classes, asynchronous, hybrid, online, electronic, e-learning, mobile learning, etc (Hargis, 2008).

Chris McCuller explains distance learning in his online paper "An Introduction to Videoconferencing and Distance Learning" as follows: "Distance learning is a relatively new educational field that focuses on delivering classroom content / instruction to students who are not physically on site. Instead, teachers and students communicate either asynchronously (at a time of their own choosing via email or other text-based communication), or using technology that allows them to communicate in real-time (synchronously)."(http://pride.valdosta.edu/Whitepaper_Distance_Learning.pdf).

Five years ago, web-based classes were the best way to reach students when teaching a course online. They were in the form of instant messaging, emailing, file uploading / downloading, message boards / news feeds, etc. Also, in some cases, the students may have the ability to connect to a live video conferencing over the internet. That has changed since the usage of Personal Digital Assistants (PDAs) and smartphones got widespread throughout the world.

In this study, an example application of a course will be examined using a smartphone (iPhone) through a syllabus designed for iPhone application development. The students will have the opportunity to reach the course through their smartphones and read the announcements, course syllabus, handouts, and solve the quizzes that are uploaded to the system by the course instructor.

1.1. BACKGROUND

Evans, et. al., describes the necessity of distance learning as follows: "Time and geographical constraints make distance education a convenient and appealing option for many students" (Evans, et. al., 2007).

Westbury (1973) mentioned the demands requested from the students to the lecturers as the following topics:

- Present and cover a body of content (meaning the syllabus)

- Evoke mastery of the material by the students (meaning efficient teaching)

- Create interest and secure compliance to the demands of the learning situation (meaning the increase of participation to the course)

- Manage the class (meaning to discipline the students)

2. DISTANCE EDUCATION

The history of distance education reaches more than 200 years back. For instance, there are evidences that Boston Newspaper gave stenography courses via letters and announced these courses through advertorial.

The first example of distance education was seen in England and it was made by sending letters. "Throughout time, humans have utilized different technological tools to enhance both basic communication and learning. For instance, humans have gone from cave drawings to web sites; from petroglyphics to blogging; from conversations to instant messaging; and from story telling to podcasting" (Hargis & Rakita, 2005).

Distance education can be defined as the study that the educators prepare the syllabus so that the students can accomplish their education on the course on themselves; it is an educational system where the student synchronously or asynchronously communicate with the lecturer on a distance using a tool.

California Distance Learning Project (www.cdlp.org) described the distance learning programs as a system where the student and the educational resources connect together and achieve an education.

The United States Distance Learning Association (www.usdla.org) describes their mission as: "mission is to serve the distance learning community by providing advocacy, information, networking and opportunity". According to their definitions, the distance education can be achieved using satellite, video, graphics, computers, and multimedia-supportive electronic devices.

There are several methods to deliver distance learning. Although distance education reminds of technological delivery sources, there have been many non-electronic delivery methods for distance education through out the years.

In a distance education course, the basic sequence is as follows:

1. The students register for the course.

2. They receive the syllabus, instructions, and assignments.

3. Completed assignments are sent back to the instructor.

4. The instructor checks the assignment and grades it.

In a distance education course, the delivery mentioned on steps 2 and 3 is best completed online by the students and the instructor. Online delivery has become widely used since it has a quick response time. It may take the form of a lecture post in which

the instructor posts a documented lecture and instructions online. Students read the lecture and then post questions for response from the instructor and other students. Online delivery may also be synchronized such that distance students log on to a course website at the scheduled time of the course to view the lecture live, and can interactively communicate with the instructor while the lecture is being taught. Thus students must keep up with the lectures or risk falling behind in the course. Live chat room sessions often serve as an additional communication supplement. (Evans, et. al., 2007).

Moller (2008) covered the topics on distance learning that Westbury mentioned in 1973 and summarized the pedagogical conclusions about the effects of distance learning to the educators as "student interactions, course content design and delivery, multiple levels of communication, defining new types of assignments and performance expectations, and different assessment and evaluation techniques". Falvo and Pastore (2005) assert "the social construction of knowledge demands the necessity of community in online classrooms and technology-rich environments." They suggest complex dynamics of a group involve interpersonal communication, conflict resolution, consensus building, and formative and summative feedback.

According to Moore (1990), there are three main elements in a distance education which are "the learner", "the teacher", and "the communication method". This communication or environment can be sustained with the help of technology. This may be via mail, radio, TV broadcasting, and computer networks or via printed materials, audio / video, and graphics.

The following are types of distance learning materials:

> ***Printed Materials*** – Course books, exercises, course timetable and syllabi, sample situations and news feed can be sent to students via mail.

> ***Audio Materials*** – Consists of materials based on audio and audio conference techniques.

> ***Video Materials*** – Consists of courses recorded on video, TV broadcasting either live or through tape

> ***Digital Environment*** – Consists of educational techniques which provide the complete or partial presentation of courses through connected computers within a network, using an interactive or independent style.

According to Keegan (1980), the defining characteristics of distance education are:

- The separation of teacher and learner which distinguishes it from face-to-face lecturing

- The influence of an educational organization which distinguishes it from private study

- The use of technical media, usually print, to unite teacher and learner and carry the educational content

- The provision of two-way communication so that the student may benefit from or even initiate dialogue

- The possibility of occasional meetings for both didactic and socialization purposes

- The participation in an industrialized form of education which, if accepted, contains the genus of radical separation of distance education from other forms.

Although distance education has become common, its use is controversial and research suggests that its effectiveness is variable and inconsistent (Rooney, et. al., 2006; Rivera, et. al., 2002; Li, 2002; Evans, et. al., 2007). Many research studies, whether comparison or case studies, have shown that distance learning is as favorable as classroom learning and that distance students are satisfied, and have similar grades or test results, compared to traditional students (Phipps & Merisotis, 1999; Johnson, et. al., 1999; Russell, 1999; Merisotis & Phipps, 1999; Bourne, et. al., 1997; Gagne & Shepherd, 2001).

2.1. ADVANTAGES OF DISTANCE EDUCATION

With the improvement of the innovative technologies, the main objective of distance education is to earn new students with respect to the traditional students. The EDUCAUSE (2002) defines traditional students as "18-23-year-olds enrolled full time in a residential campus program."

According to EDUCAUSE, the proportion of traditional university students is shrinking while the non-traditional student ratio grows.

The advantages of distance education can be summarized as:

- There may be no alternative for many students. By means of distance education, many students can reach these distance courses (Evans et. al., 2007).

- Physically disabled students can attend classes without any problems.

- If the distance option includes a recorded material, then students have the ability to use the material as many times as desired if the student finds the course material difficult, or the student misses a class. Stephenson (2001) notes that distance students may take a break when tired by stopping the recorded material,

whereas students in a traditional course do not have the same luxury, i. e., students have control over the pace of learning.

- Distance education may sharpen teaching skills (Evans et. al., 2007).

- Improvements are also possible as teachers learn how to teach, and students learn how to learn, using distance education resources (Evans et. al., 2007).

- Online learning may be cost effective, because web – based courses can be made available to an almost infinite number of students (Katz & Yablon, 2003).

- Besides money, distance learning can be time and place saving.

- Instructors who have recorded lectures from prior semesters may use these recordings in future classes (Evans et. al., 2007).

- Even the lecturer and the student is parted, distance learning serves the ability to communicate one way or both ways.

- If there is no obligatory attendance, the student may have the chance to work and study at the same time easily.

2.2. DISADVANTAGES OF DISTANCE EDUCATION

There has been considerable speculation about factors that may make distance learning a less effective learning environment for students. For example, some feel that the lack of face-to-face interaction between the student and the teacher, or among the students, is detrimental to learning. Others assert that while the learning outcomes from in-class and distance learning courses may be similar, the distance learning format may not be satisfying to students (Carr, 2000).

A report published by the Institute for Higher Education Policy reviewing the existing research on the effectiveness of distance learning in higher education (Phipps & Merisotis, 1999) concluded that learning outcomes of students enrolled in distance learning courses are similar to those of students receiving conventional classroom instruction. The report also concluded that the attitudes and satisfaction of students in distance learning are "generally positive."

Even if the results satisfy the lecturers, there are still some disadvantages of distance learning with its advantages. Some of them are (Evans et. al., 2007):

- Distance education may allow students to become lazy, using the online component as a crutch.

- In many forms of distance education, there is no live communication between the distance student and the instructor. Many instructors feel that the face-to-face contact and the student/teacher interaction are critical to learning.

- Often instructors can recognize whether the students understand the course by facial expressions of the students in traditional courses. The "reading" is not possible in distance courses.

- Group projects may be more difficult for distance students, because it may not be possible for students to meet face-to-face.

- Asynchronous distance students are at a time disadvantage as they do not have the opportunity to ask direct questions.

- Technology problems may create a disadvantage for distance students, such as the deceleration of the internet, or the disappearance of mails.

- Teaching distance education courses requires more work and preparation than traditional courses.

- The volume of e-mail created from distance students may increase dramatically for the instructor and teaching assistants and it's getting hard to reply them all.

- Distance education may create more problems with cheating and academic honesty, hence, the student may finish the course without even attending or doing the assignments himself alone.
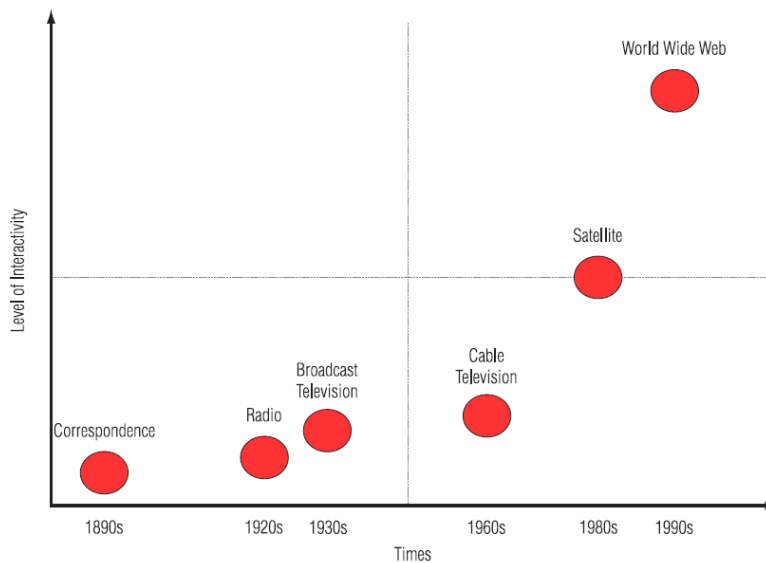
3. E – LEARNING

E – learning (also known as web – based distance learning) is a type of distance learning that is delivered via the World Wide Web (WWW). Usually, in the universities, this type of education is a credit – based education in which, at the end, the student earns a certificate or a degree.

Before the internet, interaction between instructors and students in distance learning programs was primarily one-way, through video taped lectures, tele – courses, and traditional mail correspondence courses (EDUCASE, 2002). There was no real – time activity between the student and the teacher. Colleges and universities interested in serving the non-traditional students find e – learning a valuable component of a more comprehensive study.

The following figure (EDUCASE, 2002) shows the evolution of distance learning technology:

Figure 1 - The Evolution of Distance Learning (EDUCASE, 2002)

Table 1 gives some example distance education programs of the universities in Turkey:

Table 1 - Turkish Universities with Distance Education Programs

University	Distance Education Program	URL
Ahmet Yesevi Uni.	Türtep	http://www2.yesevi.net
Anadolu Uni.	E - MBA	http://emba.anadolu.edu.tr
İTÜ	UZEM	http://www.uzem.itu.edu.tr
Anadolu Uni.	Açık Öğretim Fakültesi Bilgi Yönetimi Önlisans Programı	http://www.bilgi.aof.edu.tr
ODTÜ-IDEA	Asynchronous Internet Education	http://idea.metu.edu.tr
ODTÜ-Online	METU Online	http://online.metu.edu.tr
ODTÜ-Informatics	Informatics Online - Master of Science Program	http://ion.ii.metu.edu.tr
İstanbul Bilgi Uni.	E - MBA	mba.bilgi.edu.tr

Science educators recognize the potential of the internet as an educational tool (Hargis, 2001).

EDUCASE tells that; "The emergence of the internet and online learning has fundamentally altered the concept of educational services for this rapidly growing, fully web-based distance learning population. While eager to meet the needs of these students, many colleges and universities find themselves struggling to craft an appropriate organizational response to the realities of web-based distance education."

Palmiery (1997) has foreseen internet as the source of education with the following words: "There are many reasons for using the internet, including recent increases in equity of access, it's seemingly infinite resources, its ability to engage students as active participants, the motivational influence of Internet – based authentic learning activities, the ability to include student inquiry and cooperative learning in Internet – based lessons, and the increased means for assessment of student progress. Although the quality of information available on the Internet has been questioned, cyberspace has truly opened an information highway. Technology has gained attention in education today because of it prevalence, its promise to provide low – cost education, and its potential to help some people participate more easily, learn more effectively, and enjoy learning more."

Huang (1997) supported Palmiery and Hargis with these words: "Learning through the Internet provides the flexibility and efficiency of computer instruction as well as the individual attention of traditional instruction."

Like in all distance education courses, online courses require self-motivated students in order to be successful (McIsaac & Gunawardena, 1996).

Vrasidas and McIsaac (2000) suggested some tips when preparing an online course. These tips came out from the evaluations at the middle and at the end of the course. The tips are briefly as follows:

- Always allow enough time and plan ahead

- Do not minimize the front-end analysis phase

- Spend enough time addressing some of the questions discussed in an earlier section.

- Provide immediate feedback

- Participate in the discussions and provide enough modeling

- Promote interaction and social presence

According to their experiences, although teaching online was not as easy as it sounded, it was a great learning experience.

Scientists from Auburn University, Alabama, listed some of the major accessibility features that an e-learning portal follows (Marghitu, et. al., 2005):

- All images have text alternatives (ALT attributes), unless they are purely decorative.

- Text uses relative font size so it can be enlarged or reduced using the text size options available in visual browsers.

- Pages are organized to be fully functional, even with

- JavaScript turned off.

- Pages are designed to maintain good contrast, even without cascading style sheets.

- Pages use flexible formats so they can be automatically resized for different window sizes and screen resolutions.

- Pages are designed with separate cascading style sheets, so they can be replaced by user-defined style sheets.

- Pages validate to a maximum amount, making exceptions only to aid users with older browsers.

- The web portal uses Access Keys, meaning that someone can navigate throughout the portal without a mouse.

- The web portal follows World Wide Web Consortium (W3C) and Section 508 guidelines.

The following table is a research made in the United States by EDUCASE, giving examples of some of the companies doing Web – Based businesses in association with some universities:

Table 2 - Web - Based Businesses in Association with Universities

Company	Participating Institution(s)	Background
Fathom	Columbia Uni.	Launched in 2000 as a consortium of leading education and cultural institutions to provide knowledge and education to business and individual users.
Global Education Network	Williams College Brown Uni. Faculty from other liberal arts institutions	Founded in 1999 by Williams professors to offer high-quality online liberal art courses.
UMUC Online	University of Maryland University College	Launched in 1999 as a for-profit company to market UMUC's courses.
UNext	Columbia Uni. Stanford Uni. Carnegie Mellon Uni. University of Chicago	Founded in 1997 to offer high-impact courses and content through its subsidiary, Cardean Uni.
NYUonline	New York University	Founded in 1998 to offer career-focused courses and certificate programs.

3.1. ADVANTAGES OF E-LEARNING

There are several advantages of e-learning, or as known as web – based distance education, programs such as:

- E-learning courses are both offered to physically enabled students and to students with limited or no access to physical classroom locations.

- Gives access to adequate technology.

- Provides ever-growing source of information to both teachers and students. Teachers can introduce and use information from the internet for instruction and to supplement practically any subject matter. Used effectively, this environment has the potential to level the playing field for individual differences that have historically provided obstacles to learning (Hargis, 2001).

- Available computer programs provide an excellent opportunity to access an astronomical quantity of information. The teacher as the primary source of knowledge no longer suffices in a world where knowledge doubles every seven years and 10000 scientific articles are published every year. Forman (1987) indicates that technology adds the ability for students to choose how, when, and where they participate in the learning experience and to bring together a vast wealth of previously unavailable learning resources (Hargis, 2001).

- The students have the ability to become active participants in their own learning, self motivation, student inquiry, and assessing and improving student progress (Hargis, 2001).

- It provides the flexibility and efficiency of computer – assisted instruction as well as the individual attention (Huang, 1997).

- It has the ability to provide open communication, organized essential ideas, learning aids, modeling, active and appropriate practice, pleasant conditions, and consistency (Berge, 1997).

- Internet usage can increase student performance (Follansbee, 1997).

- Technology can help some people participate more easily in education, learn more effectively, and enjoy learning more (Palmiery, 1997).

- Technology allows learners to access knowledge in their homes and in their work places at times in which they want to learn (Palmiery, 1997).

- Online courses allow both synchronous and asynchronous interaction, that is, they allow for place and time independence. People can interact at their own time (Vrasidas & McIsaac, 2000).

- Communicating with the students via email is very satisfying, and the teacher could be certain that the message he sends is complete and clear (Kleinman & Entin, 2002).

- The teacher has the ability to answer the students' questions first thinking thoroughly and then revise the answer. He also has the ability to send private and personal messages (Kleinman & Entin, 2002).

Kleinman and Entin made a research on online education in 2002. They taught and introductory computer science course using VB during fall and spring throughout the year. In the second term of the year, they divided the students into two: one had the same course in the traditional face-to-face way, and the other got the same course online, with the same syllabi and same course books.

The comparison of the two classes can be seen below on Table 3:

Table 3 - Comparison of Responses from In-Class and Online Students (Kleinman & Entin, 2002)

Topic	In-class students	Online students	Significance of difference
Background			
Age	22.8	30.8	p<=.03*
Number of hours worked	35	33	ns**
Number of credit hours taken	33	45	ns
GPA	3.3	3.6	ns
Course Expectations			
Grade expected in course	3.7	3.7	ns
Confidence in doing well in course	3.6	3.9	ns
Course Outcomes			
How hard worked	5.8	5.7	ns
Satisfaction with expected grade	6.0	5.8	ns
Degree to which grade meets initial expectations	3.8	3.9	ns
Course Mechanics			
Course organization	6.2	6.7	ns
Helpfulness of text	6.1	6.8	p<=.14
Helpfulness of exchanges with other students	3.9	2.7	ns
Value of course			
Helpfulness of tutorials	5.9	6.7	ns
Helpfulness of research paper	4.5	4.2	ns
Overall learning from course	6.3	6.7	ns
Willingness to recommend course to others	5.9	6.5	ns
Likelihood would take course again	5.6	6.5	ns
Overall value of course	5.8	6.5	p<=.08

* p value gives probability that a difference between the means this large or larger could have occurred by chance alone

**ns=nonsignificant

One can easily see that the first aim of reaching to non-traditional students was achieved, since the average age was 30.8 on online students. Even if the number of hours worked are less than the traditional students, the cumulative GPA was higher in online students, and in overall, online students found the course more valuable.

Below is the table for the grade distribution at the end of the year for the same students:

Table 4 - Student Grades at the end of the Course (Kleinman & Entin, 2002)

Grade	In-class (n=17)	Percent	Online (n=9)	Percent
A	11	65	6	67
B	3	18		
C	2	12	2	22
D				
F	1	6		
Incomplete			1	11

Besides these outcomes, there has been an enormous increase in the number of unofficial students taking the course not as a formal registered student but as an outsider (Kleinman & Entin, 2002).

All in all, Phipps (1999) says that "learning outcomes of students in online courses are similar to those of students in traditional classes and that the attitudes of the distance learners are generally positive, in fact even more positive than the in-class students."

3.2. DOUBTS ABOUT E-LEARNING

Hargis (2001) has some doubts about the information overload and lack of useful instructional format, about identifying the necessary skills and attitudes to enable users to critically evaluate and use the resources, and about effectively designing and evaluating different learning formats. According to him, access to the internet is a potential disadvantage, too.

Pennell (1996) said that "loss of face-to-face behavioral, gestural, and tonal cues may give rise to many misunderstandings" and hence the lecturer should be aware of the need for particular attention in the educational design.

White (2000) mentioned that "being able to write clear, focused messages" is one of the competencies that instructors of online courses should have according to a focus group of online instructors."

Kleinman and Eltin (2002) says that "Writing emails to the entire class is also time-consuming. To communicate even logistical information let alone content via the written word takes much more time and craftsmanship than what an instructor can say

verbally in the classroom. I found myself spending an hour or more carefully drafting an e-mail to the class that would have taken perhaps 10 minutes to say aloud; in written form I felt I had to be extra careful to be sure of the clarity of the message, proper grammar and usage, and innuendo of tone both because my words were there in permanent form and because I would not be there to see students' immediate reaction or to clarify at once any misinterpretation."

4. MOBILE LEARNING

The growing diffusion of devices coupled with Internet access features has improved flexibility and quality of learning. Learners may study at any place, any time, and with any device in a ubiquitous learning environment, which means that the applications and services normally conducted on personal computers should be usable also on handheld and portable devices (Svetlana & Yoon, 2009).

The combination of e-learning and mobile computing is called mobile learning (m-learning) (Holzinger, et. al., 2005): it provides opportunities to interact with learning materials in different ways while exploring a physical environment both outdoor (e.g. archaeological parks, woodlands) and indoor (e.g. lab, home) (Rogers, et. al., 2005).

The decision to try a new technology, experiment with its capabilities, and then finally integrate its use into one's daily workflow and personal experience is a complicated process that has been described as adoption and appropriation (Cochrane, 2009).

Carroll et. al. (2002) define technology appropriation as "the way that users evaluate and adopt, adapt and integrate a technology into their everyday practices."

Kurti (2008) says that "Current research efforts in the field of mobile learning have been in many cases guided by a learner-centered approach. Context awareness and content adaptivity are crucial components in mobile learning environments."

The mobile learning community is only some ten years old and is unevenly spread around the globe (Traxler, 2010a). Any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of learning opportunities offered by mobile technologies (O'Malley, et. al., 2003).

Today, the definitions mobile learning (also known as m-learning) and e-learning have started to merge together since the invention of handheld devices such as netbooks, and now iPad. The availability of these handheld devices continues to create problems with the boundary between m-learning and e-learning. Keegan (2005) found a solution to this confusion such as the focus should be on the term *'mobility'*: "I feel that in the definition of mobile learning the focus should be on mobility. Mobile learning should be restricted to learning on devices which a lady can carry in her handbag or a gentleman can carry in his pocket. I therefore define mobile learning as 'the provision of education and training on PDAs / palmtops / handhelds, smartphones and mobile phones.'"

"As communication devices become more and more mobile, and as life styles adapt to this mobility, education must adapt also" says Lee (2006), and continues: "people expect to be able to send and receive information continuously as they move about,

reinventing the nomadic lifestyle. As 'Information and Communication Technology' (ICT) becomes more ubiquitous and as communication habits change, it is inevitable that educational applications will also evolve, with pressure coming both from the demand side and the supply side. That is, consumers of education will increasingly demand access to learning through the new mobile ICT delivery systems and providers of education, that is corporations, governments, and educational institutions, will seek ways to offer their instructional services to the broadest audience in the most convenient fashion, and at the lowest price."

"M-learning, being the digital support of adaptive, investigative, communicative, collaborative, and productive learning activities in remote locations, proposes a wide variety of environments in which the teacher can operate" (Laurillard, 2007). According to Nyiri (2002), m-learning is fundamentally e-Learning delivered through mobile computational devices such as Palms, Personal Digital Assistants (PDA), Pocket PCs, smart phone, digital cell phones, and any other handheld devices. This is an e-learning through mobile computational devices (Quinn, 2000). Mobile and ubiquitous computing devices are transforming the way that learners study (Svetlana & Yoon, 2009).

M-learning, which combines mobile telecommunications with the premise of e-learning, where computer-based technology is used in the education process, provides individualized training that is available anytime and anywhere (Tucker & Winchester, 2009). the emergence of mobile devices and quick development of wireless communication has opened up another alternative way for higher education institution to employ mobile learning as a mean to transfer knowledge to learners (Triandis, 1994).

"Basic problems of advanced forms of education are insufficient flexibility, mobility and adaptability to learners needs of information and education whenever and wherever it is necessary. Some of the problems find their solution in capabilities of mobile education." (Yordanova, 2007)

Over recent years mobile communication and technology has exploded with new high-tech platforms and devices supported by even more high-tech networks, and with the introduction of the iPhone into the market this trend will not relent anytime soon (Tucker & Winchester, 2009). Evidence can be found in consumer trends, which show over 1.5- billion cell phone users worldwide (Lee, 2006). This is double the number of Internet users, and the percentage of users continues to grow each year as more people switch to wireless networks (Leung & Chan, 2003). The new wave of smart phone or personal digital assistant (PDA) use is similar to the previous wave of iPod and mp3 audio and video players use a few years ago. Corporations and educational institutions are attempting to keep up with the capacity demands for wireless media and other forms of multimedia while taking advantage of the endless communication, training, and education potential in the technology itself.

17

Wireless and handheld devices give m-learning a more customized capacity while providing users with devices that may be on all of the time or always available and personalized. This customization allows wireless devices to be very collaborative and individualized tools for communication that provide a flexible means for creating educational and training tools (Tucker & Winchester, 2009).

The spread of telecommunication is evident at universities all over the United States where campuses are becoming wireless and mp3 players and advanced laptop computers are becoming institutional requirements for the students. In 2004, Duke University gave all first-year students Apple iPod devices with voice recorders. Duke evaluated the use of the iPods for 628 students in 33 courses for academic purposes that included access to course content, classroom recording, environmental audio recording, file storage and sharing, and study support (Belanger, 2005).

The benefits of mobile learning offer convenient widespread communication and information transmittal at a low cost to users worldwide for a diverse group of institutions including, governmental agencies, educational institutions, and corporations (Tucker & Winchester, 2009). Researchers such as Motiwalla (2007), state that m-learning should be used in conjunction with an existing learning environment and should be developed to support existing educational models

A study by the British Henley Management College in 2003 discovered that 46% of 25 to 34 year olds 'could not live without their mobiles'. The study described this phenomenon as akin to 'bereavement' (BBC, News, 2003).

A recent survey by the Pew Internet & American Life Project predicts that by the year 2020, most people across the world will be using a mobile device as their primary means for connecting to the Internet.

In the new 2009 Horizon Report, mobiles have moved into the "Time-to-Adoption Horizon: One Year or Less" from two to three years timeframe in 2008:

"The unprecedented evolution of mobiles continues to generate great interest. The idea of a single portable device that can make phone calls, take pictures, record audio and video, store data, music, and movies, and interact with the Internet — all of it — has become so interwoven into our lifestyles that it is now surprising to learn that someone does not carry one. As new devices continue to enter the market, new features and new capabilities are appearing at an accelerated pace. One recent feature — the ability to run third-party applications — represents a fundamental change in the way we regard mobiles and opens the door to myriad uses for education, entertainment, productivity, and social interaction."

Cell phones in our pockets are not just used as cell phones but also smart phones. Everybody looks for a new feature on each cell phone they buy. Technology

convergence is leading toward a universal device (or two devices) that will provide many user capabilities:

- Cell phone

- Wireless and cell data & internet

- Viewing of recordings, presentations, video

- Play music and audio recordings

- Gaming

- Serve as a mobile PC, capable of running at the minimum many common applications, and at the maximum a full operating system with full capabilities.

The flexibility of mobile technologies allow for the possibility of creating new education and training paradigms and theories. With the continuous evolution of mobile technologies the educational, instructional, and training possibilities are endless (Tucker & Winchester, 2009).

Keegan (2005) described the characteristics of mobile learning that it uses devices:

- Which citizens are used to carrying everywhere with them,

- Which they regard as friendly and personal devices,

- Which are cheap and easy to use,

- Which they use constantly in all walks of life and in a variety of different settings, except education

Traxler defined the capability of mobile learning in 2010b as follows:

- Enhance, extend and enrich the concept and activity of learning itself, beyond earlier conceptions of learning. This includes:

    o Contingent learning, where learners can react and respond to their environment and their changing experiences, for example data collection in real-time on geography field trips

    o Situated learning, where learning takes place in surroundings that make learning meaningful, for example learning about religions whilst visiting temples, mosques, churches and synagogues

    o Authentic learning, where meaningful learning tasks are related to immediate learning goals, for example basic literacy or numeracy in work-based learning on the job

- o Context aware learning, where learning is informed by the history, surroundings and environment of the learner, for example learning in museums, game parks or heritage sights

- o Augmented reality mobile learning, where learning builds on local context supplemented by an audio or video overlay

- o Personalized learning, where learning is customized for the preferences, history and abilities of individual learners or groups of learners

- Take learning to individuals, communities and countries that were previously too remote or distant, for example culturally, economically, socially or geographically, for other educational interventions to reach. This category has included addressing:

  - o Geographical or spatial distance, for example reaching into deeply rural areas

  - o Sparsity, connecting thinly spread and perhaps nomadic learners to create viable communities of learners, or exploiting learning niches and perhaps the 'long tail'

  - o Infrastructural or technical barriers, for example, areas in sub Saharan Africa, supporting those communities lacking mains electricity, secure clean buildings or land-line connectivity

  - o Social exclusion, for example reaching students unfamiliar with and lacking confidence in formal learning and its institutions, for example the homeless, gypsies, marginal groups, those 'not-in-education, employment-or-training'

  - o Physiological or cognitive different, and distant, for example supporting learning opportunities for the hearing impaired or people with dyslexia

  - o Privacy and connection, for example helping secluded women and girls in some cultures to access informal and social learning.

Seong (2006) drew the architecture of mobile learning course management as in Figure 2:
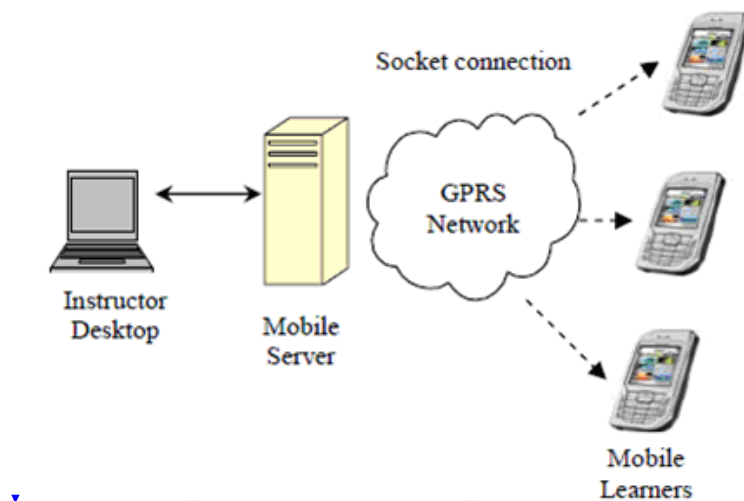
Figure 2 - Architecture of Mobile Learning Course Management

4.1. EFFECTS OF MOBILE LEARNING

Mobility has an observable effect on distance learning. Study has shown that some of these effects are:

- Effective knowledge transfer (Knight, et. al., 2007)

- Encourages both independent and collaborative learning experiences (Attewell, 2005).

- Helps learners to identify areas where they need assistance and support (Attewell, 2005).

- Helps learners to improve their literacy and numeracy skills, and to recognize their existing abilities (Attewell, 2005).

- Helps learners to remain more focused for longer periods (Attewell, 2005).

- Helps to combat resistance the use of information and communications technology (ICT) and can help bridge the gap between mobile phone literacy and ICT literacy (Attewell, 2005).

- Helps to raise self-confidence and self-esteem (Attewell, 2005).

- Helps to remove some of the formality from the learning experience and engages reluctant learners (Attewell, 2005).

- In one study of college students, 62 percent reported they felt keener to take part in future learning after trying mobile learning. Of the 62 percent, some expressed a future preference for learning with laptops (91 percent), on a PC (82 percent), using mobile devices (80 percent), with friends/people of their own age (76 percent), at college (54 percent). About 82 percent of respondents felt mobile learning games could help them to improve their reading or spelling, and 78 percent felt these could help them improve their math (Attewell, 2005).

- A survey is conducted among students involved in Bachelor of Science (BSc.) and Master of Science (MSc.) programs at Sofia University (www.uni-sofia.bg) at age 19 - 26 years old and results of the survey about their attitude to m-learning and its integration in education is presented on Figure 3. About 62% appreciate the concept of mobile learning very much and just 10 % of the students do not the idea at all (Yordanova, 2007).
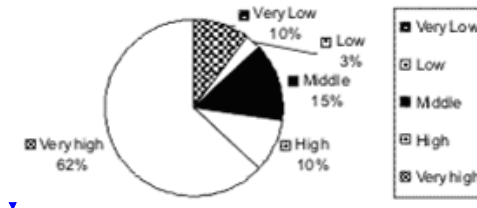
Figure 3 – M-learning Attitude Survey Results

- Cochrane (2009) made a survey among 3 different classes of students, year 1, year 2, and year 3. The comparative survey feedback can be seen on Table 5. Reflective events were scheduled throughout the projects to capture participant feedback including:

  - Pre-trial surveys of lecturers and students, to establish current practice and expertise

  - Post-trial surveys and focus groups, to measure the impact of the wireless mobile computing environment, and the implementation of the guidelines

  - Lecturer and student reflections via their own blogs during the trial. The blog is also an online e-portfolio facilitating the collection of rich media resources capturing critical incidents and providing a dynamic journal of student projects and lecturer input.

Table 5 - Comparative Survey Feedback (Cochrane, 2009)

End of project survey question	Student agreement/satisfaction with statement (strongly agree plus agree)		
	Year One (%)	Year Two (%)	Year Three (%)
4. What has been your experience of group work facilitated by blogs and RSS?	100	66	80
6. It was easy to use the smartphone	58	83	90
7. This mobile learning experience was fun	86	100	90
8. Based on my experience during this trial, I would use a smartphone in other courses	56	66	90
9. I would be willing to purchase my own smartphone	43	50	80
11. In your opinion, does mobile learning increase the quality of learning?	43	67	60
12. Mobile blogging helped create a sense of community (group work)	43	33	60
13. Accessing your course blog was easy using the mobile device	56	66	50
14. Mobile learning increases access to education	70	66	80
15. Communication and feedback from the course lecturer/lecturer were made easier	43	16	70
16. Mobile learning is convenient for communication with other students	42	66	70
Average	54	62	75

Besides these effects of mobile devices on learning, their most popular advantages are mobility, ease-of-use, power management, expandability and adaptability, popularity, and performance support.

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4.2. CONSIDERATIONS ON MOBILE LEARNING

Most of learning contents, designed for desktop, are not suitable for handheld devices (Svetlana & Yoon, 2009). There is also the concern about the small screen size, which is not so well suited to e-learning delivery and restricted input capabilities (Lee, 2006). According to Karkkainen and Laarni (2002), small screen display with short lines slow down speed of reading by disrupting the normal pattern of eye movements and indirectly affects human interaction. The default settings and style-sheets, such as image size, font size, and layout structure, are not suitable to present on portable devices. As a result, a technique is needed to compose and deliver adaptive content from any platform in any format to any device through any network at anytime anywhere (Yang, 2006).

According to Hayhoe (2001), the small display screen and the limited brightness and contrast are the most significant design restrictions of handheld devices. He adds that reading in low resolution reduces reading comprehension significantly. After mentioning the screen limitations, he offered some solutions such as to apply bold, italics and color with caution, display text in larger type, and employ graphics with very minor supporting roles.

Besides their small screen, portable devices are equipped with limited computing powers and they have distinct capabilities compared with desktop / laptop computers (Svetlana & Yoon, 2009). Although there are limitations about the capabilities of mobile devices, some researchers offered solutions to these problems.

Ninomiya, et. al. (2007), mentioned that the data transfer could be a problem when downloading media (audio, video, or printed material). Many students have limited Internet contracts on their phones, or pay for the mega bytes (MB) they download / upload, i.e., network access costs are significant. Hence Ninomiya, et. al. (2007) recommended a system for users when users revisit the same system with similar requirements.

Zhao and Okamoto (2008) have also offered a solution where the system detects the mobile device's capabilities and serve according to these capabilities and the student's preference.

Other than the technical issues, conceptual limitations must be taken into consideration. Trifonova (2003) suggests some instructional design tips:

- Short modules (no more than 5-10 minutes long)

- Simple, funny, and added-value functionality

- Area and domain specific content, delivered just in time and place

Naismith (2006) makes some extra suggestions that involve the environmental considerations: "In order to transform learners from passive recipients of information to active constructors of knowledge we must give them an environment in which to participate in the learning process, and the appropriate tools to work with that knowledge. Mobile devices give us a unique opportunity to have learners embedded in a realistic context at the same time as having access to supporting tools."

Some other challenges of mobile devices:

- They make it easier to involve in plagiarism

- They are more fragile than other types of computers and can be more easily stolen or lost

- Existing applications need to be adapted for mobile devices at considerable expense

- Security is a major issue

- There is little stability in the market because of rapid development

- Implementations can be complicated by restrictions imposed by mobile service providers

All in all, as in every new technology used, there are also some disadvantages on mobile learning, but they are not insolvable problems as can be seen above.

5. IPHONE PROGRAMMING PREREQUISITES

Here are the basics you need on hand before you begin programming for the iPhone or iPod Touch.

1. **Apple's iPhone SDK**

   Download iPhone SDK from Apples iPhone Dev Center. The URL is (http://developer.apple.com/iphone/). You must join IOS (Apple's Mobile Operating System) developer programme.

2. **An iPhone or iPod Touch**

   Actually, IOS SDK has a simulator but if you really do need to have a real unit to test on if you will decide to develop an important application.

3. **iPhone Developer License**

   You cannot test your application on an iPhone or iPod if you do not join iPhone Developer program. You can find detailed information on this URL about the developer programme. (http://developer.apple.com/iphone/program).

4. **An Intel-based Macintosh running Leopard or Snow Leopard**

   Apple requires an Intel-based computer in 32-bit mode. Many features do not work properly on PPC-based Macs or Intel Macs in 64-bit mode. At least 1GB of RAM and plenty of disk space must be reserved.

5.1. ENVIRONMENTAL COMPONENTS

iPhone development environment components are:

1. **Xcode**

   Xcode is a debugger on Mac OS X. Xcode provides a comprehensive project development and management environment, complete with source editing, comprehensive documentation, and a graphical debugger.

2. **Simulator**

   The iPhone Simulator runs on the Mac OS X and it provides you to simulate and test your software on your local environment. You do not need a connecting to

an actual iPhone or iPod equipment. The Simulator offers a preview of how your concept designs will look.

3. **Interface Builder**

Interface Builder (IB) provides you drawing out and prototyping your interface with visual design tools and connecting screen elements to objects and methods to call in your software.

5.2. PLATFORM LIMITATIONS

- Storage Limits

- Data Access Limits

    You can access any data that is if the data completely available on the Internet when the iPhone is connected to a network.

- Memory Limits

    Memory management is the most important issue for iPhone. Disk swap is not supported on iPhone. If your iPhone is out of memory, it reboots. Because of this limitation you have to manage memory carefully.

- Interaction Limits

    Focus your design standards rather than on desktop applications. Do not forget that, you can use just one window at a time unlike desktop applications that are free to use multi-window displays.

- Energy Limits

- Application Limits

5.3. THE OBJECTIVE-C LANGUAGE

Objective-C is a reflective, object-oriented programming language which adds Smalltalk-style messaging to the C programming language. Today, it is used primarily on Apple's Mac OS X and iOS: two environments based on the OpenStep standard, though not compliant with it. Objective-C is the primary language used for Apple's Cocoa API, and it was originally the main language on NeXT's NeXTSTEP OS (http://en.wikipedia.org/wiki/Objective_c).

According to Apple Developer Center, Objective-C adds a small number of constructs to the C language and defines a handful of conventions for effectively interacting with the runtime system.

27

5.3.1. MESSAGES

The message is the name of a method plus any arguments passed to it.

Message expressions are enclosed in square brackets: [receiver message]

The receiver can be:

- A variable or expression that evaluates to an object (including the variable self)

- A class name (indicating the class object)

- super (indicating an alternative search for the method implementation)

5.3.2. DEFINED TYPES

The principal types used in Objective-C are defined in objc/objc.h. They are:

- id: An object (a pointer to its data structure).

- Class: A class object (a pointer to the class data structure).

- SEL: A selector, a compiler-assigned code that identifies a method name.

- IMP: A pointer to a method implementation that returns an id.

- BOOL: A Boolean value, either YES or NO. Note that the type of BOOL is char.

- Nil: A null object pointer, (id) 0.

- Nil: A null class pointer, (Class) 0.

- NO: A boolean false value, (BOOL) 0.

- YES: A boolean true value, (BOOL) 1.

5.3.3. COMPILER DIRECTIVES

Directives to the compiler begin with "@". The following directives are used to declare and define classes, categories, and protocols:

- @interface: Begins the declaration of a class or category interface.

- @implementation: Begins the definition of a class or category.

- @protocol: Begins the declaration of a formal protocol.

- @end: Ends the declaration/definition of a class, category, or protocol.

- @private: Limits the scope of an instance variable to the class that declares it.

- @protected: Limits instance variable scope to declaring and inheriting classes.

- @public: Removes restrictions on the scope of instance variables.

5.3.4. CLASSES

A new class is declared with the @interface directive. The interface file for its superclass must be imported:

```
#import "ItsSuperclass.h"
@interface ClassName : ItsSuperclass < protocol_list >
{
        //instance variable declarations
}
//method declarations
@end
```

Everything but the compiler directives and class name is optional. If the colon and superclass name are omitted, the class is declared to be a new root class. If any protocols are listed, the header files where they're declared must also be imported. A file containing a class definition imports its own interface:

```
#import "ClassName.h"
@implementation ClassName
        //method definitions
@end
```

5.3.5. NAMING CONVENTIONS

The names of files that contain Objective-C source code have the .m extension. Files that declare class and category interfaces or that declare protocols have the .h extension typical of header files. Class, category, and protocol names generally begin with an uppercase letter; the names of methods and instance variables typically begin with a lowercase letter. The names of variables that hold instances usually also begin with lowercase letters. In Objective-C, identical names that serve different purposes don't clash. Within a class, names can be freely assigned:

- A class can declare methods with the same names as methods in other classes.

- A class can declare instance variables with the same names as variables in other classes.

- An instance method can have the same name as a class method.

- A method can have the same name as an instance variable.

- Method names beginning with "_", a single underscore character, are reserved for use by Apple.

Likewise, protocols and categories of the same class have protected name spaces:

- A protocol can have the same name as a class, a category, or anything else.

- A category of one class can have the same name as a category of another class.

However, class names are in the same name space as global variables and defined types. A program can't have a global variable with the same name as a class.

6. COURSE DESIGN

6.1 COURSE SYLLABUS

A course syllabus on teaching Objective-C and iPhone programming was prepared and divided into weeks, starting from the editor environment and a simple Hello World, to importing media to an iPhone application.

Week 1

- Class Introduction
- Xcode environment and developer program portal
- Objective-C Part 1
- Objective-C Part 2
- Hello World iPhone App

Week 2

- MVC and understanding the view hierarchy
- Overview of standard UIKit controls
- MVC and understanding controller functions
- More info on UIViewController classes

Week 3

- Table Views Part 1
- Table Views Part 2
- Retrieving information from remote servers
- Storing information on the device

Week 4

- Quartz 2D
- Animation

- Tracking touches

- Using the camera and image library

Week 5

- The Accelerometer

- Location awareness

- Media (sound, music, movies)

6.2. IPHONE DEVELOPMENT MOBILE LEARNING COURSE SCENARIO

First of all, the students download the "MLearning" application for iPhone:

Figure 4 - The "MLearning" Application

Secondly, they login the system with the username and passwords given. The username is the student number, and the password is a field containing at least 8 characters, 5 alphabetic and 3 alphanumeric chars.

Figure 5 - Login Screen
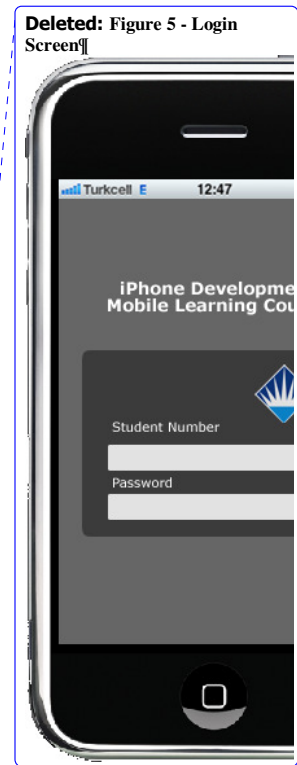
The screen looks like Figure 6 when the students move the cursor on any of the text fields and start inserting characters in the fields:
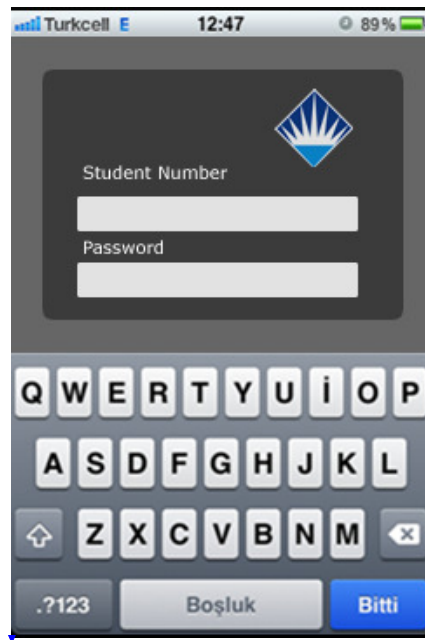
Figure 6 - Login Screen When Typing
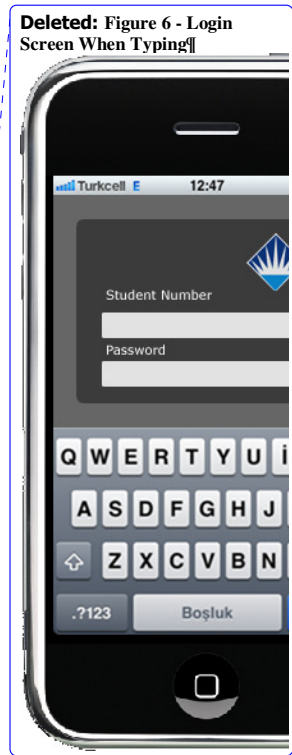
The following screen is the "Loading" screen, appears when the student types his student number and password, and then hits enter:
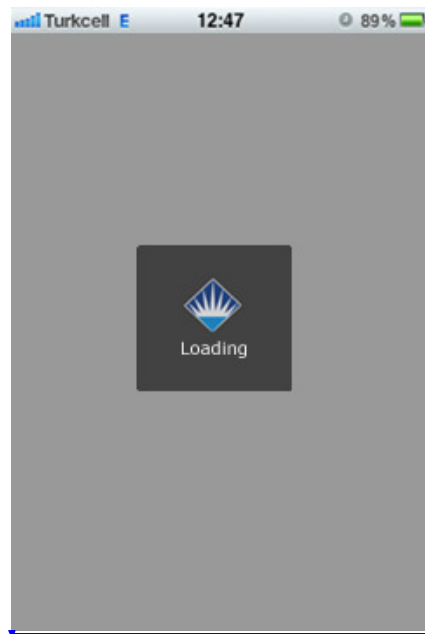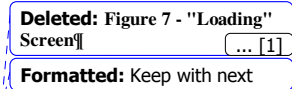
Figure 7 - Loading Screen

When the login is successful, there comes a notifications screen on which the student sees the latest notifications. He has to go through the notifications before surfing on the main menu.
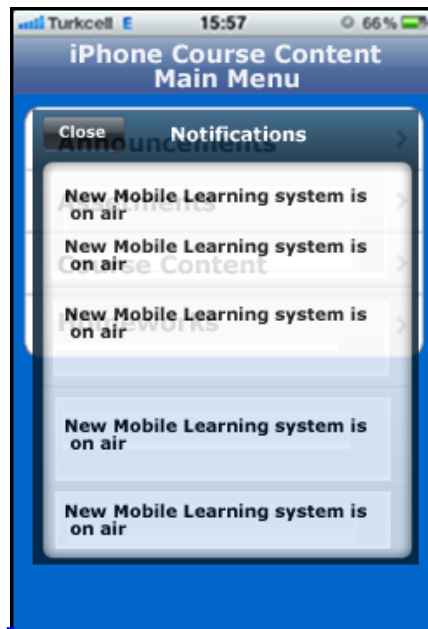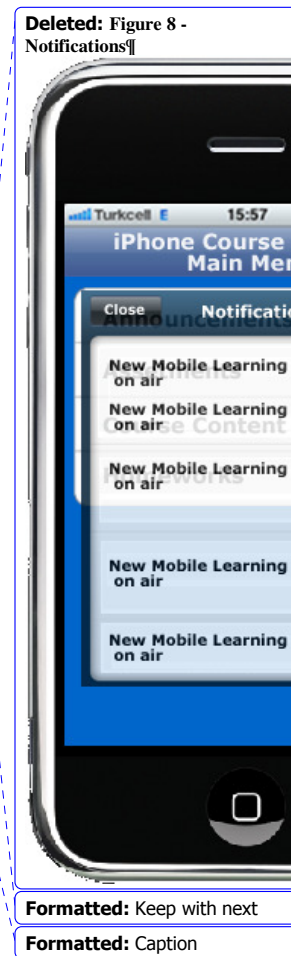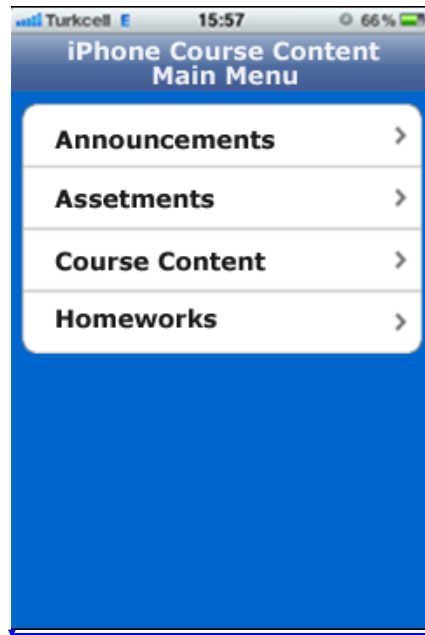
Figure 8 - Notifications

The following is the main page, on which the student can access his announcements, assessments, the course content (i.e. the syllabus), and his homeworks.
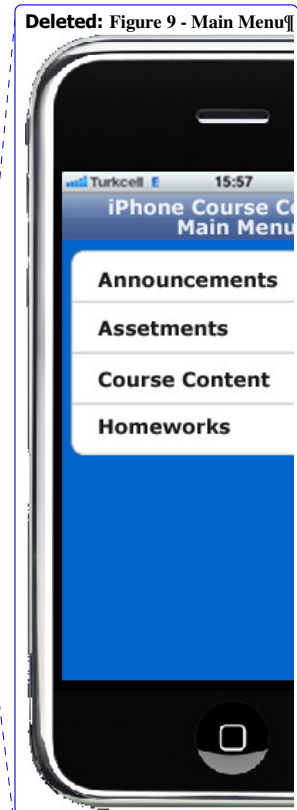
Figure 9 - Main Menu

The student is not permitted to submit any homeworks or assignments; they are just read-only. The student has to submit his homework through email.
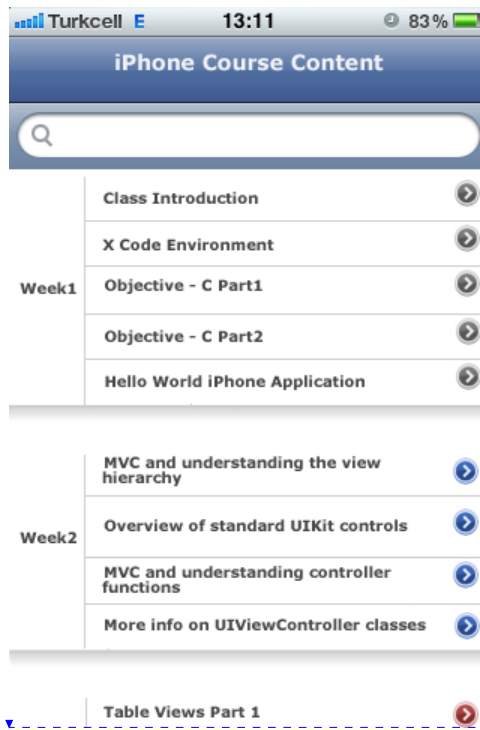
Figure 10 shows the Course Content page, which is designed considering the design issues mentioned before. It has colorful but simple content, large font and minimum number of visual material.

Figure 10 - Course Content Page

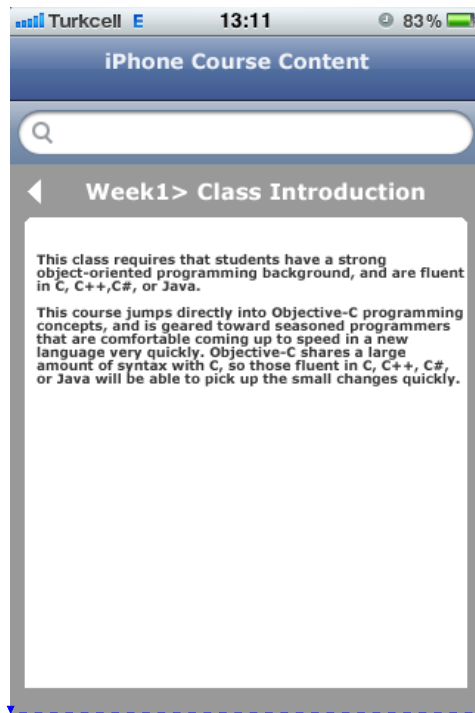When the student rolls his mouse over a topic, the screen looks like Figure 11:
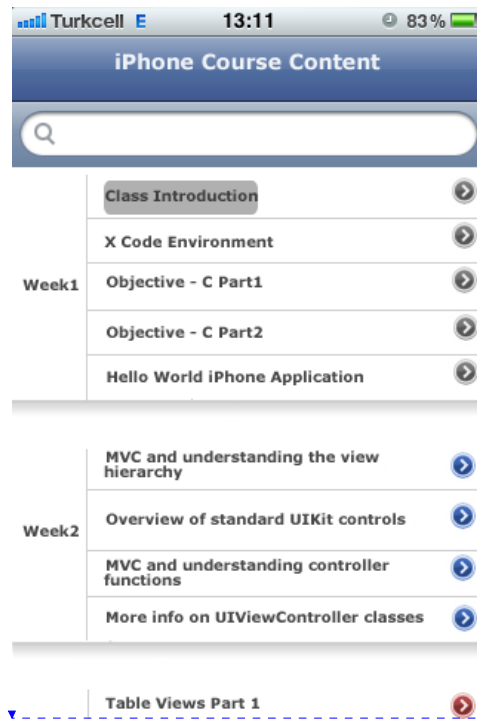
Figure 11 - Mouse Over Effect on a Link

When he hits a topic, the topic content from the pdf file can be viewed on a white background with grey borders:

Figure 12 - Topic Content

7. EXPERIENCES

What we have come across during this thesis was the hardness of learning Objective-C to implement the mobile learning module. The interface builder was easy to learn, but the editor, Xcode, was complexer, which confirmed the rumors about Xcode: "Learning Objective-C takes one hour to learn if you know C++, but learning Xcode takes 1 week."

The second problem was to use a computer running on MacOS. It was expensive, and the version I bought wasn't up-to-date. When I tried to upgrade the iPhone SDK, it was impossible to upgrade to a level more than 1 step. My operating system was version 10.5, and the SDK I tried to download was 4.1. Because I had 10.5, I could only have the permission to download SDK version 3.0, but the web site didn't provide SDK that one.

If you want to be a official developer, or want to implement programs not associated with a university, you have to buy a license to develop official programs. Even you have the license, downloading it to an iPhone (or iPod) is complicated. You send your implemented program to App Store, and wait for them to confirm your implementation. Then, the users can download it after all these mixed processes.

Formatted: Heading 1, Centered, Indent: Left: 0 cm, Hanging: 0,5 cm, Space After: 10 pt, Line spacing: 1.5 lines, Outline numbered + Level: 1 + Numbering Style: 1, 2, 3, … + Start at: 5 + Alignment: Left + Aligned at: 0 cm + Tab after: 0,63 cm + Indent at: 0,63 cm

8. CONCLUSION

To sum up, the need to distance education and the first examples of distance education was discussed in this study. After the invention of the Internet, e-learning portals rose. Some of the e-learning modules in Turkey were introduced as well as the e-learning modules abroad. There are both university supported applications and business supported applications.

The growing diffusion of devices coupled with Internet access features has improved flexibility and quality of learning. The access to mobile devices has increased through the past 10 years, as with the demand to knowledge. With the ability to reach information with an "anytime and anywhere" principle, the gain of knowledge moved from desktop computers and laptops to handheld devices called "mobile devices". Some of the universities explained on the section above started using mobile learning and shared their experiences. According to their experiences, the success was almost the same with face-to-face learning.

These results oriented institutions to use mobile learning, because it reduced the money spent for the education, reached lots of people, both informal, non-traditional students and students that were incapable of joining a lesson physically joined the lessons that were mobile. Mobile learning also improved the skills of the lecturer, because he has to be more specific and clear when teaching a lesson. Besides these effects of mobile devices on learning, their most popular advantages are mobility, ease-of-use, power management, expandability and adaptability, popularity, and performance support.

E-learning modules were designed for large screen computers, but when the definition "mobile learning" came into our lives, the modules' converting into mobile devices was inevitable. There had some points that had to be taken into consideration such as designing suitable screen layouts for small and low-resolution screens, the limited capabilities such as speed and memory, unable to prevent plagiarism, more fragile devices that can be easily stolen and lost, the expense of converting the online resources into mobile resources, security, lack of stability because of the improving technology, and restrictions of the service providers.

After discussing the distance learning, e-learning, mobile learning and their applications, a syllabus for learning Objective-C and iPhone Application Development was introduced, and in the light of the topics discussed above, a mobile learning module for this course was modeled.

In this model, the student logs on the system using his student number and password, meets the notifications for him, downloads course syllabus (course content) and reads the topics introduced on the syllabus week by week, topic by topic.

41

This project was not implemented fully due to the non-existence of mobile devices (in this study, iPhone application was implemented) in every student. After providing these mobile devices to every student taking the course, or ensuring that everybody has a mobile device to join the course, the project will be fully implemented.

Future work will be done by recording the time the student stays in a module / chapter / topic, the login and logout periods, examining quiz / homework results and at the end of the course, the behavior of students will be analyzed according to their academic and personal history of education and family.

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CURRICULUM VITAE

FULL NAME	:	Metin YENİDOĞAN
ADDRESS	:	Kartaltepe m. Atatürk c. No:29/10
		34040 Bayrampaşa / İstanbul / Türkiye
EMAIL	:	metin.yenidogan@turkcellteknoloji.com.tr
BIRTH PLACE / YEAR	:	İstanbul - 1984
LANGUAGE	:	Turkish (native), English
HIGH SCHOOL	:	Maçka Akif Tuncel Anatolian High School
UNIVERSITY	:	Computer and Instructional Technologies Education, Bahçeşehir University, 2007
MSc	:	Bahçeşehir University, 2010
NAME OF INSTITUTE	:	Institute of Science
NAME OF PROGRAM	:	Computer Engineering
WORK EXPERIENCE	:	TurkcellTeknoloji, Oracle CRM Consultant (2010 - …)
		KoçSistem, Oracle CRM Consultant (2007 - 2009)

Figure 7 - "Loading" Screen