

IT Education using Smart Phone: An e-Learning Approach

BY
Mohammad Faisal Imran Khan
STUDENT NO. 0805110

Submitted to the Department of Computer Science and Engineering
In partial fulfillment of the requirements for the degree of
Bachelor of Science in Computer Science and Engineering
June, 2014

SUPERVISED BY
Professor Dr. A.S.M. Latiful Hoque
Department of Computer Science and Engineering
BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

Certificate

I hereby declare that this work has been done by me and neither this thesis nor any part of it has been submitted elsewhere for the award of any degree or diploma except for publication

Muhammad Faisal Imran Khan

Acknowledgement

I convey my utmost gratefulness to my thesis supervisor Professor Dr. A.S.M Latiful Hoque, Computer Science and Engineering, BUET for suggesting me to work on E-learning; later on the topic “IT Education using Smart Phone”. In the thesis, his encouragement in e-learning and valuable comments, problem solving instructions paves a way to build an Android App for IT students.

It is a prodigious learning experience with him of how thesis is done; in which pattern to do a thesis. His guidance and instruction helps me a faster way to acquire knowledge about thesis.

I want to convey my gratitude to my parents without whose support it might not be possible for me to reach up to this position.

Finally I want to thank all my teachers, classmates and laboratory attendants who gave support in research.

Abstract

The inclusion of IT courses in secondary and higher secondary education has created a

challenge in Bangladesh for teaching and learning the IT contents for which sufficient numbers of trained instructors are not available in the country. The application of Technology Enhance Learning (TEL) and Mobile Learning (m-learning) in addition to Blended Learning (BL) can be effective to solve this problem. Technology Enhanced Learning is a culture where a wide range of learners e.g. full-time, part-time, professionals, overseas etc. are provided with a robust technology environment which provides the learning opportunities wherever the learner chooses. Mobile learning is defined as, learning across multiple contexts, through social and content interactions, using personal electronic devices. In other words, with the use of mobile devices, learners can learn anywhere and at any time. Blended learning is a formal education program in which a student learns at least in part through online delivery of content and instruction with some element of student control over time, place, path, and/or pace and at least in part at a supervised brick-and-mortar location away from home.

Mobile devices are now available to almost all the people of our country. Internet facility is also spreading rapidly to the distant part of our country. So it is now very easy to implement system based on these three models. Here, we have developed a system named e-Learning with Mobile Apps (e-LMA) for effectively self learning and self evaluation by students based on these models.

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Bangladesh is a third world under developed country in south-east Asia. It has a vision to turn into a digital one through a mass progress in the field of IT and IT education [1].

Under the existing curriculum at the secondary and higher secondary level of education, there is provision for imparting both theoretical and practical lessons in computer science. All secondary schools are supposed to have both computer laboratories and a sufficient number of qualified teachers. The reality is that, in cities and towns, most schools are well equipped and student can learn about computer even at home from house tutors. But in rural areas where most schools do not have sufficient numbers of computers and qualified teachers and most students do not have any scope to learn about computer at home, this subject is not taken seriously either by students or by their teachers [2]. There are around 14,669 secondary schools and 1,185 higher secondary colleges [3] in Bangladesh. Building infrastructure and ensuring skilled man power for IT education in each of them is a quite impossible problem. A poor computer lab facility of rural area is shown in Figure 1.

Figure 1: Poor Computer Lab facility in rural area

To solve this problem of lack of sufficient resource and manpower on IT Training, we can find a solution in our available technologies in our country. We have recently got 3G technology Internet [4] [5] access in our country. Though it is now limited to main cities only, we can expect that it will expand in our remote places in next few years. In addition to that, high performance android based smart phone devices are now available at a very low cost in our country [6] [7]. So it is now very easy to reach, connect and share data among people. So, if we can use these technologies in a guided way then we can use it to expand education among our people in a cost-effective, faster and more generalized way. If we spread learning stuff on IT in web through a guided system, then more people can learn about IT. In addition, using smart phone to access the learning stuff will make learning enjoyable to students.

1.1 Problem definition

So the problem is to develop a cost-effective system so that-
Using this system,

IT Students should be able to-

- Collect and study learning contents anywhere, anytime.
- Appear test for self-evaluation.
- Interact with teacher by asking questions.

And their teachers should be able to-

- Interact with student questions.
- Design and develop course contents in a student friendly way.
- Develop test sets, so student can self-evaluate themselves.

1.2 Scope of the work

Primarily, we have prepared the m-learning system named e-LMA that includes question bank for self evaluation tests, android app built for e-content learning, web blog and sms system for teacher-student interaction, feedback system for developing new course contents for html-learning part in higher secondary level of education. By preparing, guideline and video demonstration for other course like programming language learning, digital logic learning etc. this model can be used for these subjects too.

1.3 Objectives

The objectives of this research are to develop a mobile based e-learning system named e-LMA to-

- assist the students of secondary and higher secondary level to self-learn the IT course,
- improve learning by self evaluation and
- Assist teachers to develop course content according student feedback.

1.4 Thesis Organization

Chapter 2 describes m-learning systems with blended model developed so far, for education purposes. Also some important terminology and details of m-learning tools are also discussed here. A brief discussion on Android OS is also discussed.

Chapter 3 describes e-LMA system architecture and flowcharts.

Chapter 4 describes our implementation of e-LMA. It also states its purpose as a blended learning model and m-learning model.

Chapter 5 concludes the report showing the short comings and the future works of the model.

Chapter 2

Literature Study

M-Learning Study is a very recent idea. In a research paper named “Mobile Learning in the classroom” [8] D. McConatha & M. Praul gave a pretty good idea about how its innovation was. From that paper, some beginning story of m-learning is depicted here. Seppala and Alamaki [9] investigated the training and instruction of Finnish teachers using mobile technology in the classroom. Their experience and concerns with the new technology centered on three factors. Firstly they noted that, given that 98% of Finland’s university students owned cell phones in 2002, instruction via mobile learning opportunities seemed to be an important next step in the digital learning revolution. In their study of the use of SMS text messaging and digital pictures, content material was sent to a centralized memory bank. Each user could “withdraw” this material at any time for review and study. The teachers regarded the ability to take notes at any time and being able to work on materials during their daily travel time as a second advantageous feature. Feedback on educational content was offered almost instantaneously given the characteristics of the devices being used (cell phones, PDAs etc.), and the researchers felt

that this third factor this allowed them to be more honest in their responses and opinions about the potential of mobile learning. Seppala and Alamaki concluded by deciding that mobile-learning has a multitude of advantages, and that its technology has a place in the teaching arsenal of the future. According to Wagner and Wilson [10] cell phones now outnumber land-line phones in America, and other wireless devices are gaining footholds with the help of workplace and community WiFi networks. The authors make an important distinction between M-Learning and E-Learning. They argue that as different devices and new delivery tools provide educators with far more options to reach today's students, the education community must recognize that the model of "command and control," associated with the latter is being replaced with a chance to make learning truly collaborative and interactive for students, and professionals. Thornton and Houser [11] have recently reported on their study of data and opinions regarding M-Learning and its use in a Japanese University. In Japan web enabled mobile phones, PDAs, and other portable media devices are extraordinarily prevalent and the populace is well versed in how to use them. In this study the investigators evaluated outcomes measures for classroom material using mobile phones, both via e-mail and using WAP technology for web enabled phones. It is important to note that in Japan rates for cell phone plans are far less expensive than in the United States, allowing more students to take part in M-Learning study and research. The results of their experiments were very revealing. The researchers observed improvements in test scores ranging from between 35% and 75%, using pre-post test measures over paper materials alone. The students' reactions to this new learning opportunity were positive, although more so for the PDA trials than for the cell phone. The researchers note that since the cell-phone is so well established in Japan, distributing educational material through them is a relatively painless process. They stress that interactivity in content seemed a superior teaching method when compared to using static web pages alone for conveying material. Corlett et al. [12] report on a small class of students at the University of Birmingham who were given wireless PDA's for a semester to enable them to take part in an experiment on the possibilities and limitations of M-Learning in a college atmosphere. Students were familiarized with the capabilities and limitations of the hardware and then proceeded to use them for class work. The problems students reported to researchers were mostly technical in nature, for example having problems with limited memory of the handheld device or the battery life being too short. There were also some issues with the software used for the trial. At the end of the school year, discussion panels were held and a series of questionnaires were administered. The students' experiences were mixed. The PDA had a good deal of promise in their opinion, but they felt these devices did not live up to expectations. The hardware limitations of the devices used and software issues were enough for the students to offer somewhat lower ratings to M-Learning approaches than in some other studies. Nevertheless the authors see these data as supporting information that can help improve upon the hardware and technology as these devices become more ubiquitous in educational settings. M-Learning has shown increasing penetration at the professional level as well. Gomez [13] has discussed how lessons and lectures delivered to students via mobile devices are evolving. He examined podcasts, audio and video files and how they can be easily incorporated into courses. In general the outcomes were rated very highly. After an initial period of training and acclimation comments on how staff and students experience these opportunities were measured. His students report that they enjoyed the ability to pause and segment lectures and to listen to them on their own time. An additional feature that

was rated as highly valued centered on the fact that much of this information was readily available when students were away from their desktops. He also reports that roadblocks do still exist however. Echoing Wagner [14] he says that foremost among these issues is the fact that all students do not necessarily have access to the required hardware.

Now we discuss important terminologies and tools related with m-learning.

2.1 Blended Learning

Blended learning is a formal education program in which a student learns at least in part through online delivery of content and instruction with some element of student control over time, place, path, and/or pace and at least in part at a supervised brick-and-mortar location away from home [15].

2.1.1 Blended Learning Parameter

From studies, it can be shown that, learning system can be called blended learning only when

- Student learns through a mix of online/offline and supervised brick and mortar/remote.

2.2 Technology Enhanced Learning (TEL)

JISC [16] defines a Technology Enhanced Learning culture where the wide range of learners e.g. full-time, part-time, professionals, overseas etc. are provided with a robust technology environment which provides the learning opportunities wherever the learner chooses.

2.3 M-Learning

M-Learning is defined as, learning across multiple contexts, through social and content interactions, using personal electronic devices [17]. In other words, with the use of mobile devices, learners can learn anywhere and at any time [18].

2.3.1 M-Learning Parameter

According to A. Chakma [19], e-learning can be a convenient form of education, when-

- students are self-motivated
- student wants to learn
- students are free from interruption/interference.
- course is well designed for learning

And an additional element for m-learning is

- student is skilled at operating using mobile devices [20]

2.3.2 M-Learning Tools

We have used some e-learning tools for our m-learning purpose. According to A. Chakma, their definitions are given below-

2.3.2.1 Learning Object

Learning Objects Characteristics are-

- Learning objects are a new way of thinking about learning content. Traditionally, content comes in a several hour chunk. Learning objects are much smaller units of learning, typically ranging from 2 minutes to 15 minutes.
- Are self-contained – each learning object can be taken independently
- Are reusable – a single learning object may be used in multiple contexts for

- multiple purposes
- Can be aggregated- learning objects can be grouped into larger collection of content, including traditional course structures
- Are tagged with metadata – every learning object has descriptive information allowing it to be easily found by a search.

What Metadata is

One of the key issues in using learning objects is their identification by search engines or content management systems. This is usually facilitated by assigning descriptive learning object metadata. Just as a book in a library has a record in the card catalog, learning objects must also be tagged with metadata.

2.3.2.2 Web blog

Blogs Characteristics:

- A journal style of presentation, including the dates and times of blog entries. Most recent entries are usually listed first.
- Frequent (often daily) updates
- An informal, conversational style
- The diversity of subject matter, often including brief musings, commentary on internet and other social issues.
- Additional commentary contributed by blog visitors.
- Links to other blogs and websites.

2.3.2.3 Learning management system

A learning management system (LMS) is a software application for the administration, documentation, tracking and reporting of training programs, classroom and online events, e-learning programs, and training content.

A robust LMS should be able to do the following

- Centralized and automate administration
- Use self-service and self-guided services
- Assemble and deliver learning content rapidly
- Consolidate training initiatives on a scalable web-based platform
- Support portability and standards
- Personalize content and enable knowledge reuse.

An additional tool, so that the e-learning becomes m-learning is Mobile devices. According to wiki [21] we give a brief description to mobile devices.

- **Mobile devices**

A mobile device is a small, handheld computing device, typically having a display screen with touch input and/or a miniature keyboard.

A handheld computing device has an operating system (OS), and can run various types of application software, known as apps. Most handheld devices can also be equipped with Wi-Fi, Bluetooth, and GPS capabilities that can allow connections to the Internet and other Bluetooth-capable devices, such as an automobile or a microphone headset.

Much like in a personal digital assistant (PDA), the input and output of modern mobile devices are often combined into a touch-screen interface. Smart phones and PDAs are popular amongst those who wish to use some of the powers of a conventional computer in environments where carrying one would not be practical.

For mobile devices, one of the most common platforms to build apps is Android OS. According to wiki [22], we give a brief description to Android OS-

- **Android Operating System**

Android is an operating system based on the Linux kernel with a user interface based on direct manipulation, designed primarily for touchscreen mobile devices such as smartphones and tablet computers. The operating system uses touch inputs that loosely correspond to real-world actions, like swiping, tapping, pinching, and reverse pinching to manipulate on-screen objects, and a virtual keyboard. Despite being primarily designed for touchscreen input, it also has been used in televisions, games consoles, digital cameras, and other electronics.

Android is popular with technology companies which require a ready-made, low-cost and customizable operating system for high-tech devices. Android's open nature has encouraged a large community of developers and enthusiasts to use the open-source code as a foundation for community-driven projects, which add new features for advanced users or bring Android to devices which were officially released running other operating systems. The operating system's success has made it a target for patent litigation as part of the so-called "smartphone wars" between technology companies.

Chapter 3

Mobile Learning System in Blended Model

We have developed a mobile learning System, to fulfill the m-learning and blended learning goals. We have then created some IT related learning objects to fulfill the IT learning goals.

3.1 System Architecture

This smart phone based e-learning system has been divided into two parts: client side mobile app and server side database application. The system architecture is shown in Figure 2.

Figure 2: **System Architecture**

In the system, there are two main subsystems. First one is the client side mobile app. Student interacts with the client side one. Client side system interacts with server side system. Teacher interacts directly with the web-based system. This system consists of three modules: registration module, test set module and web based question generation module. The registration modules confirm registration for student and teacher. Test set module provides test set to client app on request. This module also stores student answer

and feed backs. The web based question generation module stores question-sets submitted by teacher into the database.

3.2 Process Details and Flowcharts

In the first day teachers meet with the students in a live session. Student's enrollment is performed in this session. In the second class, teacher gives them an android app to install in the android set. Then, every day student attends class lecture and along-side class lecture; use the app as a helping hand. This system is designed to motivate student to self learn new topic on IT and then self evaluate their skills.

To access this app, student needs to login first. Then he/she selects a test topic. Then if question set on that topic is available then it will be downloaded. Along with question set, a guideline to solve the questions will also be downloaded. Student at first go through the guideline, then approach for the questions. If any problem seems too hard, he/she can visit a web blog, whose link is also given with the guideline. After test, he/she gives feedback about the guideline system. If no question-set is available, students can notify teachers by sending sms. Student activity diagram is depicted below in Figure 3.

Figure 3: **Student Activity Diagram**

Teacher checks about new comment on weblog and answers to them in most descriptive as possible, so that student can easily learn about the topic.

Teacher also regularly check for new notification sms. When a sms is received he/she immediately make new questions sets. When building new question sets, he/she checks the notification page and the feedback page. If new notification pending, he/she immediately make's new sets of questions according to notification and feedbacks. If recent feedback says, his/her questions are getting harder then comparatively descriptive guideline for the students should be prepared. After question set is made, teacher will immediately inform the student. Teacher activity diagram on creating new question set is depicted in Figure 4.

Figure 4: **Teachers Activity Diagram**

At top of the course hierarchy is class. A class consists of many subjects, a subject consists of many books, a book consists of many chapters, a chapter consists of many sections and a section consists of many questions. For each question, there are multiple answers of which student have to choose the right answer. A test set will have many questions selected by the instructor.

We have used php codeigniter_2.1.0 mvc framework, mysql-5.5.24 database to build the server. To do some auto check facility, we have used jquery. To ensure security, php sessions are used. To deliver data to client app, xml and json format are used.

We have built the system with android api-17 platform. To store questions, xml database is used. To connect with server http client is used. Programs are built to extract data encoded in xml and json format. Shared preferences are used to store small data.

4.1 e-LMA for Blended Learning

Student uses the client side android app. By using this android app, student can learn with self evaluation and appear test. Student selects a test. At first, student read through hints. If basic is clear, then starts giving answer. After all answer is given, correct and wrong ones will be shown.

Teacher uses the server side website. Using this website teacher can set question bank using web, upload file, create test set for the student for any topic. When setting a question, for inserting Bangla text, ovro keyboard is used. For inserting English text, normal keyboard is used. When inserting Mathematics or Scientific symbol, the letters '&' and '<' are never used. They create problems in the android set during display. Symbols to use for math are found in the link [23]. Figure 5 shows inserting new question to build a question bank and Figure 6 shows uploading image file into the server.

Figure 5: Inserting new question

Figure 6: Uploading File

We have implemented HTML Learning section of higher secondary level IT course. The system is discussed with an example of HTML. Suppose one day, teacher has given a lecture on html. It is in rural area and no good demonstration facility in class room. Teacher has used blackboard and chalk for the demonstration and student only can get an idea but no practical knowledge on how it really works. Then student comes back home and grab his/her mobile phone, login to the app e-LMA. The home page is shown in Figure 7.

Figure 7: **Inside e-LMA**

First, he selects the Selection Button. The selection page is shown in Figure 8.

Figure 8: **Select HTML Learning**

Here, he selects HTML learning.

A pdf with guideline to learn html can be downloaded. This guideline page is shown in Figure 9.

Figure 9: **Guideline PDF**

This pdf consists of a video tutorial on html learning, a live example on html learning. This video tutorial is shown in Figure 10.

Figure 10: **HTML Tutorial**

Guideline page also has a link to web blog to discuss on html learning. This web blog is shown in Figure 11.

Figure 11: **Blog to group discuss**

Now, he selects Take Test in the home page in Figure 7. It is our intention to build the guideline sufficient so that after going through them, students can easily solve all questions in the test. These problems are designed in a way to assist students in evaluating their skills over learning materials. A question on HTML learning is shown in Figure 12.

Figure 12: **Self Evaluation**

After test student gives feedback about how useful is the guideline system for his/her study. Feedback system is shown in Figure 13.

Figure 13: **Feedback System**

When no question set on a topic is available student can ask for more questions using sms. It is shown in Figure 14. Every sms to the question administrator will cost an amount of money fixed by mobile phone operator.

Figure 14: **SMS for more questions**

Alongside sending sms to problem setter, it also creates a new notice in the web server. Figure 15 demonstrates the notification page. This notice says which chapter needs to insert more new questions.

Figure 15: **notice for problem setter**

4.2 e-LMA as an m-learning system

Though, we did not run survey or experiment about the success rate of our m-learning system in an educational institution, we have tried to measure the performance of the

system, as an m-learning system, considering the m-learning tools specified in section 2.3.2.

We have used the following tools in our system:

- Client app is built with android api-17. Symphony w82 is used as the application running device. This suffices as the mobile device needed for m-learning.
- We have used video tutorials as the learning object and the guideline pdf as the metadata for the video tutorials.
- We have created a blog from the www.blogger.com and used it for our HTML learning purpose.
- We have built a Learning Management System using php codeigniter_2.1.0 and mysql-5.5.24, where students get their guideline, study resources and also can appear different tests.

Chapter5

Conclusion

We have developed e-LMA for the ease of IT education of secondary and higher secondary level of students. In this system, we have -

- Stored e-contents in a server, so that students can access them from anywhere, anytime.
- Developed an android app for students to appear in self-evaluation tests.
- Developed a web blog where teacher-student, student-student, teacher-teacher interaction can occur.
- Developed sms system for student to make urgent sms to course teacher for new test sets or learning contents.
- Developed feedback system, where feedback is taken after each self-evaluation test.
- Developed question-entry module in server for teacher to build new test sets.

But we also have some limitations. We have developed e-LMA for a test environment.

We have used PC as the host and used the wireless LAN is used to connect with Android phone. We have prepared test sets and learning contents only on the topic “HTML Learning” for ICT in HSC level in app. For the real application we need a real server to host the main site. We also need expert manpower to prepare standard question set and appropriate guideline for different levels of secondary and higher secondary courses.

5.1 Future Work

In future, we will try to use this system as part of IT related course in an educational institution. After running a session a feedback will be taken and we will use it to evaluate our system. Using Evaluation Knowledge we will implement the system for IT courses for all the Secondary and Higher Secondary students in our country.

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