Developing of mLearning for Discrete Mathematics based on Android Platform

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Abstract

In this paper, we present Discrete Mathematics Learning system based on Android operating system. The objective of this system is to advise student to learn discrete mathematics more convenient on mobile platform. The design approaches and functional components of this system were described and this application was developed on Knowledge. In this project, it was divided the result by the research purposes into 2 parts: developing the Mobile application for students and testing and evaluating the system. Black box technique was used to evaluate application performances and Questionnaires were applied to measure user satisfaction with system usability by experts and students.

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1. Introduction

In the recent years, smart phone has been prevalently used as a significant device to support in many aspects of life. With no longer barrier by space and time, advance technologies has changed the way of e-Learning and mobile learning systems. According to MoLeNet[1], mobile learning was defined “The exploitation of ubiquitous handheld technologies, together with wireless and mobile phone networks, to facilitate, support, enhance and extend the reach...

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of teaching and learning.”. Mobile learning is a technology that was developed to support learners and teachers through Internet via electronic devices. Laouris and Laouri (2008) presented that the change from e-Learning to m-Learning implied that the revolution did not change in terminology but also in a mind-set of learning environments. Mobile learning opens the boundaries of learning to support learners to learn anytime anywhere.

Discrete Mathematics is one of the essential subjects in computer science field and most students have problems in learning in this subject. Therefore, the purpose of this research aims to develop a mLearning System for Discrete Mathematics to support students in case of Suan Sunandha Rajabhat University. To increase the knowledge and educational experience Mobile and web base technology are adapted to help learners and to manage the course or lesson, content, and activities. Moreover, it is also beneficial to apply this model to different courses.

The remainder of this paper is organized as follows. Section 2 presents related works used in this work. Section 3 we describe the experimental design based on the purposed model and section 4 shows the results of this experiment. Finally, the conclusion and future research are presented in section 5.

2. Related Works

In this section, we describe the related concepts used in the specific literature and also adapted in the proposed application. Gwo-Jen Hwang, Po-Han Wu, Hui-Ru Ke (2011) conducted an experiment on an elementary school in natural science course to evaluate the effectiveness of the proposed method and the experimental results show that the proposed approach not only enhances learning attitudes, but also improves the learning achievements of the students. According to Price,., and et.al (2014), they described the application was designed to be customizable by teachers and ,based on collected data from observation, video and interviews, the design process and trial illustrate application use, how it supports a geospatial approach to science education and raises issues around mobile technologies, teacher pedagogies and adoption. Also there are many researches that have been investigated in the mobile learning environment. For example, Schuck et al (2013). proposed design-based method to implement in smartphone and Rattanachai et al (2014) developed the lifestyles of Thai Buddhist application based on Android operating system to learn about lifestyle of Thai Buddhist serving. Also, there are many related research that were considered in this project.

3. Experimental Design

The research aims to develop mobile learning system in Discrete Mathematics subject and the sample of this project consisted of 45 first year students in the second semester during academic year at Suan Sunandha Rajabhat University. Also, this research is the quasi experimental research and, on the development of learning and teaching, the instruments used to collect data were: 1) a questionnaire and interview forms inquiring about the mobile learning course 2) a lesson plan for Discrete mathematics course 3) an achievement pre-test and post-test 4) a questionnaires inquiring the students’ opinion for this application. The collected data were analyzed by the statistical means ($\bar{x}$) and standard deviation (S.D.).

In order to implement the mobile learning application, RAD (Rapid Application Development) was used and user’s requirements were analysed for design processes to indicate student’s interesting in a mobile learning device and this prototype is effectiveness and usefulness to enhance their abilities. The architecture of the system consists of 3 parts: the User Interface part, the Application part, and Data Storage part including instructor, student and resources. In the user interface part receives input from the user and sends the information to the related parts for processing. Student can register his/her profile, such as personnel information, email address, username and password, and etc., and he/she is assigned to take pre-test so as to initialize the student profile. Moreover, students can search supplementary information on demand by choosing the words or phrase appeared in the content page. In learning content module will prepare content for learning through the web. This module consisted of conversion lesson content from an instructor, creating a data file in an appropriated format, and indexing the topic and the contents of the lesson in database content. Search module will display results related with the lessons.
4. Experimental Results

In this section, experimental results were separated to 2 parts: developing the Discrete Mathematics Learning system based on Android operating system and evaluating the performance and satisfaction of the application.

4.1. Developing the Discrete Mathematics Learning system based on Android operating system

Developing the Discrete Mathematics Learning system based on Android operating system, Student must have account before logging into the system and a new user has to create an account profile. In the experiment of this study, students took a pre-test and completed a questionnaire for analysing their knowledge before participating in the mobile learning. Also, user can search for available learning resources, learn the interested lessons and take an exam.

A teacher can check for available learning resources, add resources and update resources. The example page in back-end system based on web application that enables a teacher to add a resource, manages a class, and report to users.

3.2 Testing and Evaluating the Discrete Mathematics Learning system based on Android operating system

The system was evaluated by freshman students at Suan Sunandha Rajabhat University. This study took places in a class with 45 students. The experimental results showed that the project can help student learning and reduce time consuming study. To evaluate the effectiveness of learning material collected data from test and post-test was analyzed and measured by using E1/E2 effectiveness with 80/80 condition.

\[
\begin{align*}
E_1 &= \frac{\sum X}{A} \times 100 \\
E_2 &= \frac{\sum F}{B} \times 100
\end{align*}
\]

When

- \(E_1\) = the efficiency of process
- \(E_2\) = the efficiency of performance result
- \(\sum X\) = total score from lesson testing
- \(\sum F\) = total score from post-test
- \(A\) = Total score of lesson testing
- \(B\) = Total score of post-test
- \(N\) = total number of students

The result shows the post-test mean score was 48.50 or about 80.89% and the final-test mean score was 25.68 or about 80.99%. The efficiency of learning (E1/E2) was 80.89/80.99.

| Test                | Total score | S.D. | %  |
|---------------------|-------------|------|----|
| Post-test scores    | 60          | 4.86 | 80.89 |
| Final-test scores   | 30          | 2.32 | 80.99 |
| The efficiency of learning (E1/E2) | 80.89/80.99 |

To test and evaluate the qualities of the system, Black box Testing and Questionnaires by teachers and students were used to test this application. Black Box testing was assessed in the error of the project as following: functional requirement test, Function test, Usability test, Performance test and Security test. The ability of this application was
evaluated by Functional Requirement test in needs of the users and Functional test was used to evaluate the accuracy of the system. Usability test was tested the suitability of the system. Performance test was used the processing speed of the system. Finally, Security test was evaluated the security of the system and Table 2 was shown the results of Black box testing.

Table 2 The results of Black box testing

|                  | Teachers |            | Students |            |
|------------------|----------|------------|----------|------------|
|                  | \bar{x}  | SD         | \bar{x}  | SD         |
| 1. Function Requirement Test | 4.18     | 0.62       | 4.03     | 0.75       |
| 2. Functional Test           | 3.91     | 0.74       | 4.03     | 0.66       |
| 3. Usability Test           | 4.06     | 0.76       | 4.25     | 0.74       |
| 4. Performance Test         | 4.15     | 0.55       | 4.03     | 0.80       |
| 5. Security Test            | 3.91     | 0.55       | 4.29     | 0.78       |
| Summary                 | 4.07     | 0.67       | 4.10     | 0.74       |

The results were satisfactory as followed: Means for teachers and students were 4.07 and 4.10, and standard deviation for teachers and users were 0.67 and 0.74 respectively.

5. Conclusion and Future Works

In this paper, the Discrete Mathematics Learning system based on Android operating system was proposed and this application can assists students to enhance student’s abilities in discrete mathematics class. The experimental group had significantly better performance in learning achievements. This system can be beneficial to use in different courses so that students can enhance and improve their ability and also this system supports teachers in handle and manage their course. However, in term of the future experiments, we are looking forward to advanced algorithms to support in learning preferences and interest of learners based on social networks and to create adaptive learning for learners.

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