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THE IMPLEMENTATION OF M-LEARNING IN LEARNING CALCULUS II

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Abstract

Calculus II is a course containing basic concepts of mathematics which is required to follow the following courses: Calculus III and Differential Equations, Vector Analysis, Real Analysis, and Numerical Methods. The researchers examine that many students found difficulties in this subject and it resulted in low learning outcomes.One of the advance or progress in the field of education is shown by the process of learning that no longer teacher-centered but student-centered. The issue requires the experts to develop learning process which implied to student centered learning. Mobile learning (m-learning) is one of models that suit with the issue. The purpose of this paper is (a) to describe the implementation of m-learning in learning calculus II, and (b) to determine and obtain an overview of the mobile-based learning process. The methodof

this study is Research and Development (R&D). The respondents in this study is the fourth semester students, 2014/2015 year academic. This model of learning combines some elements such as technology device, social aspect, and the students themselves. The process of learning is begining by downloading the learning material application to be installed into mobile device based of OS Android, Windows, and daniOS. After finishing the installation, the users can start to browse the material. The facilities provided by the material supplier are different, depends on the needs and the purpose to be achieved.

Keywords
M-Learning, Technology, Calculus II

1. Introduction

The use of information and communication technology in education continues to grow in variety of strategies and patterns. The variety could be grouped into the system of m-learning as a form of learning that utilizes electronic devices and digital media, and mobile learning (m-learning) as a form of learning which specifically utilizes the device and mobile communications technologies.

The pprogress in education field is marked by a learning process that is no longer teacher centered. In this case, the teacher acts as a facilitator for students. In other words, students should be completely become the subject of study. This illustrates that students have to find information, process it, and construct their own knowledge. However, teacher still has a role in guiding students.

Mobile learning is current paradigm in the world of learning. This model emerge to response the development of information and communication technology, especially information technology and mobile communication that recently grow rapidly. Thus, m-learning can be implemented nlearning mathematics for primary, secondary, andhigher education level. In addition, the mathematics learning using m-learning will be noticeably different compare to conventional way. The aim of this research is to describe the implementation of m-learningin learning calculus II.

2. Literature Review

In this study, word *learning* could be best defined as a process, or method to make person learn. Word *learning* also means as trying to obtain intelligence or knowledge, change behavior or responses caused by the experience. *Learning* means that the process is student centered, while term *teaching*means that the process is teacher centered. The process of helping learners to build a concept or principle on their own through a process known as internalization of learning

Hudoyo (2002) describes thatin learning mathematics the internalization process is carried out by educators and learners by thinking about mathematical ideas that allow one's mind to work basedon these ideas. According to Muhsetyo (2008: 26), mathematics learning is the process of providee learning experiences to learners through a planned series of activities so that the students acquire competency in mathematics. Moreover, Suhito in Muslich (2007: 233) adds that "in order the goal could be achieved, the teacher should be able to organize all the components so that all components can interact in harmony".

In connection with the use instructional media, Sadiman (2000) and Sukiman (2011) provide definition that media in education is anything that can be used to deliver message from sender to the receiver so that it can stimulate mind, feelings, concerns, and interests of the receiver as well as the student's attention so that the learning process occurs in order to achieve the learning objectives effectively. From the definition above, it can be concluded that media in the learning system serves as an information carrier in the form of knowledge from the teacher to the learner.

Based on its function, Arsyad, (2011) elaborates that learning media has some characteristics, those are: (1) Fixative, means that media has the ability to record, store, preserve, and construct an event or object; (2) Manipulative, means that media has the ability to manipulate or transform an event or object; and (3) Distributive, means that media allows an object or event to be transported through space.

The use of instructional media in education is one of learning innovation. This is in line with definition proposed by Ibrahim (1988: 40), that innovation is an idea, items, events, and method that perceived or observed as a new thing for a person or group of people. Thus, learning innovation is new effort in learning that is done to support the improvement in education.

In line with the definition above, Santyasa (2006) argues that learning innovation arises from changes in learning paradigm. The changes of learning paradigm originated from the reflection of the existence an anomaly old paradigm to new paradigm that is hypothesized able to solve the problem. In connection with lecturers in higher education, currently, anomaly learning paradigm still exist, among others: (1) the tendency of teachers to act as a transmitter, a source of knowledge, omniscient; (2) lectures tied to a tight schedule; (3) study directed by the curriculum; (4) the tendency that the content of the lessons and theory as the basis of learning; (5) tolerate the habits of memorizing; (6) tend to be competitive; (7) the class becomes the main focus; (8) the computer is seen as an object; (9) the domination of static media use; (10) limited communication; and (11) the assessment is normative. Unfortunately, that paradigm could not facilitate learners to involve in society.

There are various examples of innovations in learning, such as approach on learning strategy, instructional media, instructional aids, teaching methods, curriculum, classroom management, and learning-based technology. The change in the field of technology, particularly information technology (IT), brings a new paradigm to towards learning materials and learning method.

Nowadays, IT products provided an alternative form of learning materials that can be used and accessed by learners not in paper form, but in the form of CD, DVD, flash, and others. The core of the material is in the form of programs or applications that can be used whether simply to retrieve data, read, download and even to interact between programs with learners and teachers by utilizing the computer as the primary device. In learning terminology the concept is known as computer-based learning or CBI (Computer Based Instruction). In this regards, the computer is not only meant as a science to be learned but the computer as a tool that helps to learn a wide range of subject matter, in other words computers as a tool. In more complex systems, IT integrate internet-based computer program as a first step of the existence of e-book, e-learning, e-journals, e-dictionary, e-laboratory and so on (Darmawan, 2012).

M-learning system is the use of technologies intended to help learning process that is packaged in the form of mobile or digital and requires means of web-based computer in the internet site in its implementation. Basically m-learning implies expanding the role and impact of technology, and provide a wide range of teaching process. The application of m-learning can

facilitate: formal and informal training and learning activity, teaching and learning process, activity and community of electronic media users such as internet, intranet, CD-ROM, Video, DVD, television, mobile phones, PDAs, etc (Darmawan, 2012).

The use of m-learningis very beneficial. Its benefits could be seen from educators and learners' perspective. For educators, the benefits of m-learning among others: (a) improving the packaging of the learning materials, (b) helping implement new, innovative, and efficient concept of learning strategies, (c) maximizing learners access, (d) maximizing resources within the internet, (e) helping apply multimedia as learning materials, and (f) broaden learning interaction and learning sources.

Whereas from the learners' perspective, the benefits of m-learning namely: (a) improving communication with teachers and other learners, (b) providing more learning materials that are accessible regardless of time and space, and (c) providing variety of information and materials that organized in online learning materials.

3. Research Method

The method used in this study is Research and Development and respondents of the research are fourth semester students, 2014/2015 year of academic in Mathematics Education Program, Faculty of Teachers' Training and Educational Sciences, UNINUS.

4. Findings and Discussion

In the era of information technology, approaches and models that facilitate the learning of students and educators began to be developed. After emergee and develop the conceptt oflearning multimedia then develop mobile learning.

This condition shows that there has been a shift in the meaning of the renewable multimedia concept that has begun to be replaced with a mobile concept. This phenomenon is also change programmer's paradigm to be able to create hybrid learning that unites mobile multimedia concept with a dish of innovative learning. In ddiscussions about the theory and practice of learning technologies in form of m-learning materials development, capabilities and support are needed.

These capabilities relate to the ability to analyze the curriculum starting from the basic

competence, teaching materials, content or material analysis, material that will be developed, and syllabus or lesson plans. Moreover, it also required the ability to analyze teaching materials, as well as the ability to analyze the availability and the carrying capacity of modern instructional media, especially media based on Information and Communication Technology (ICT).

On the other hand the initial requirement that must be possessed is the ability to install applications that support the production of teaching materials m-learning both offline and online (Darmawan, 2012).

4.1 The use of m-Learning

In this research, m-learning refers to learning activity using cellular phone as the primary device. Cellular phonewas used due to its effectiveness and efficiency as easy use and flexible device. Regardless of all the things that are owned by cellular phone itself, the operating system (OS) is the main thing. Thus, cellular phone with Android OS, Windows, and ions became the main prerequisite in the development of m-learning.

The steps of implementation m-learning, namely:

- Student's downloads-calculus applications available on *Google Play, Windows Phone Store,* and *the App Store*, according to the device in cellular phone.

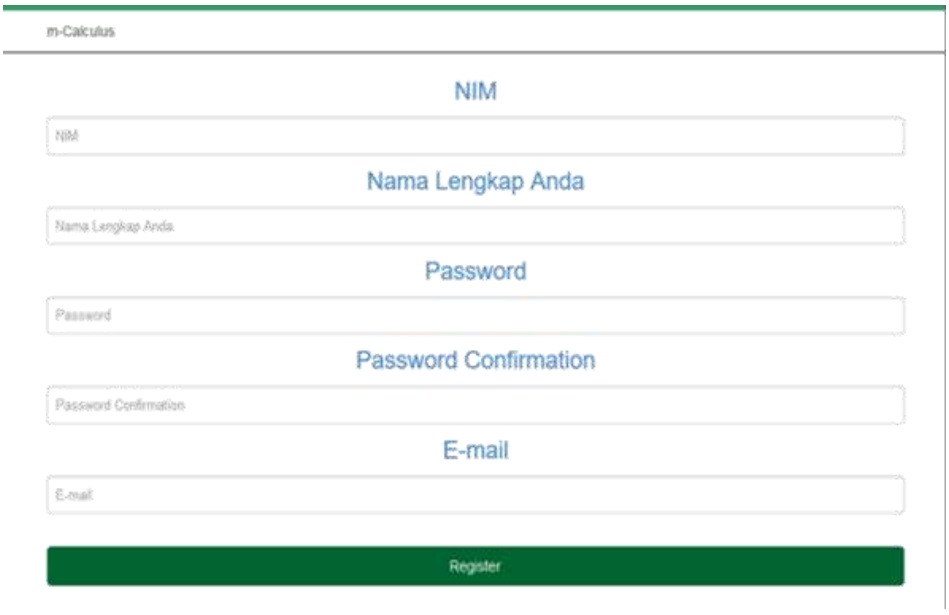

Figure 1: *Registration window in m-calculus*

Students then register by createing a username to login. The next step, student login by typing username and password.

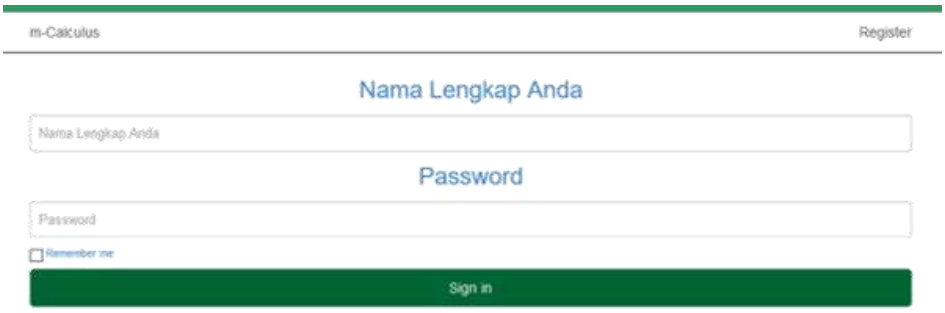

Figure 2: *Log in window in m-calculus*

When a user clicks on log-in, it will automatically be directed to the next window containing a menu of learning.

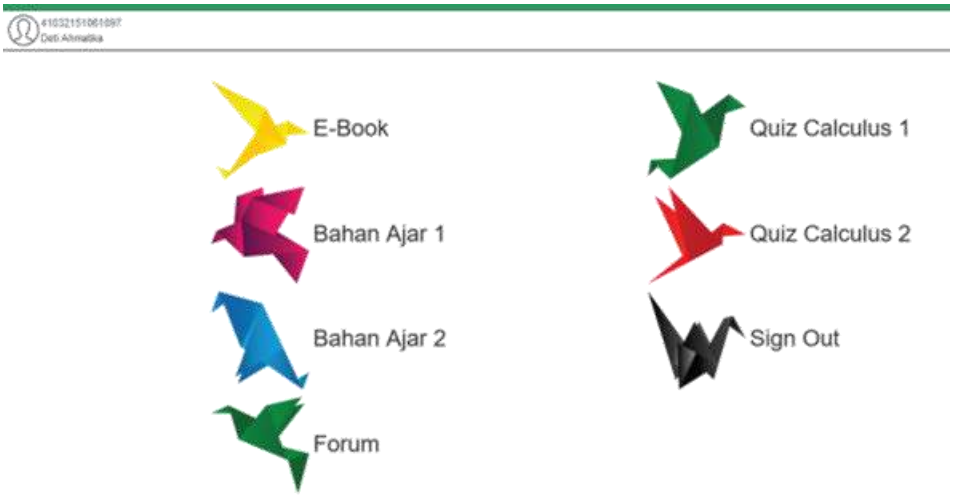

Figure 3: *Learning menu in m-calculus*

In this window the user can select the desired learning menu. E-Book menu contains learning materials related to the other sources of books, while teaching materials menu contains learning materials, and learning quiz menu provides daily test and evaluation of learning.

- Lecturer assign students to learn particular chapter in such applications. For example, Chapter 1, calculus on anti-derivative materials (indefinite integral) by using them-learning, m-calculus.

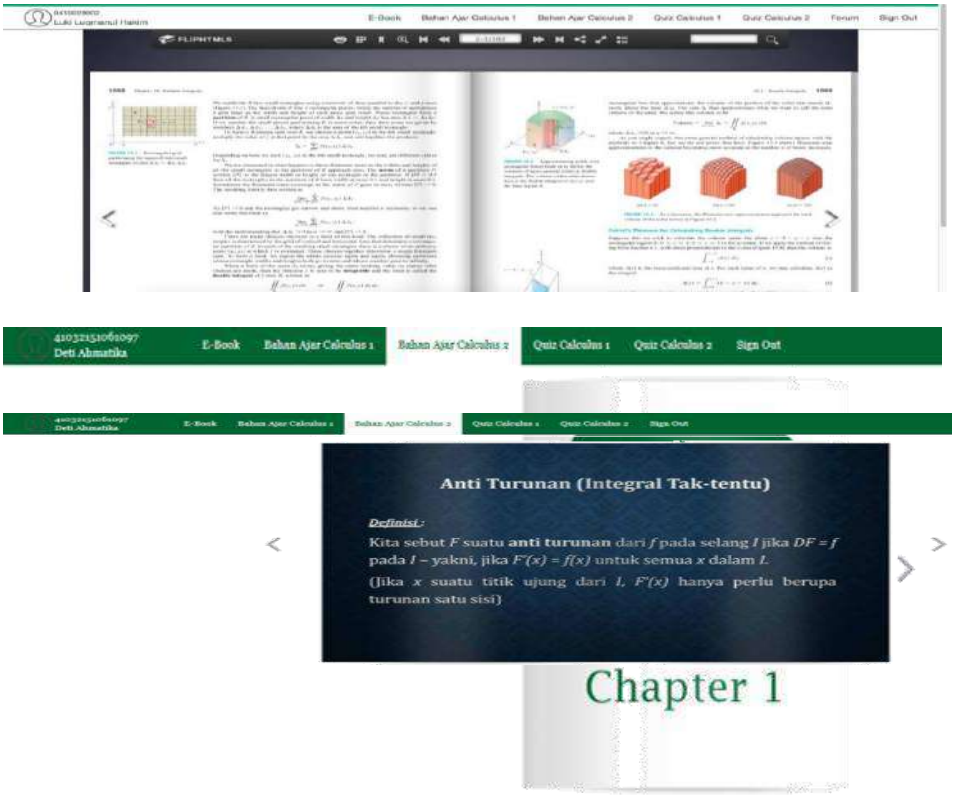

Figure 4: *Example of learning material in m-calculus on anti-derivative material*

If there is material that poorly understood, the student can ask the lecturer via chat on messenger calculus.

Figure 5: *Calculus messanger window*

This calculus messenger feature is still not maximized yet, used during the learning since there is no feature to send pictures and equation so that students can only communicate with lecturer in form of plain text only.

- Lecturer provide online quizzes for each chapter.

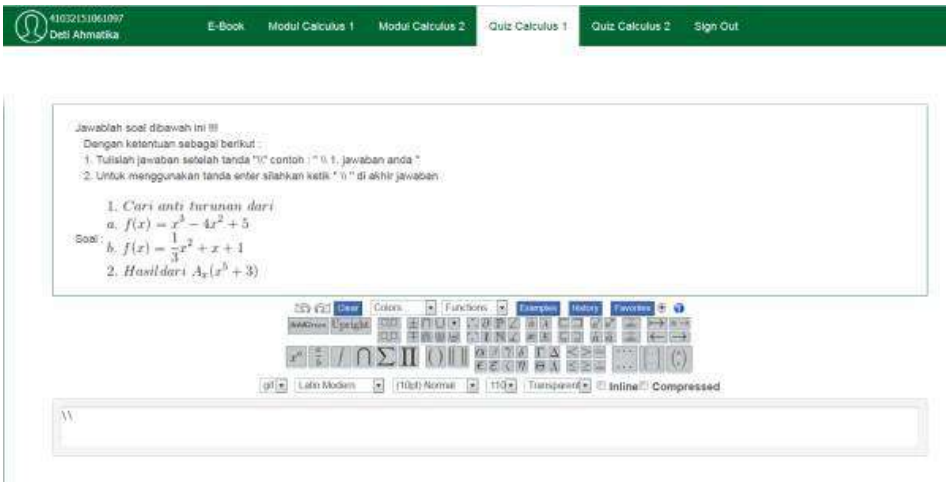

Figure 6: *Example of online quizon anti derivative material*

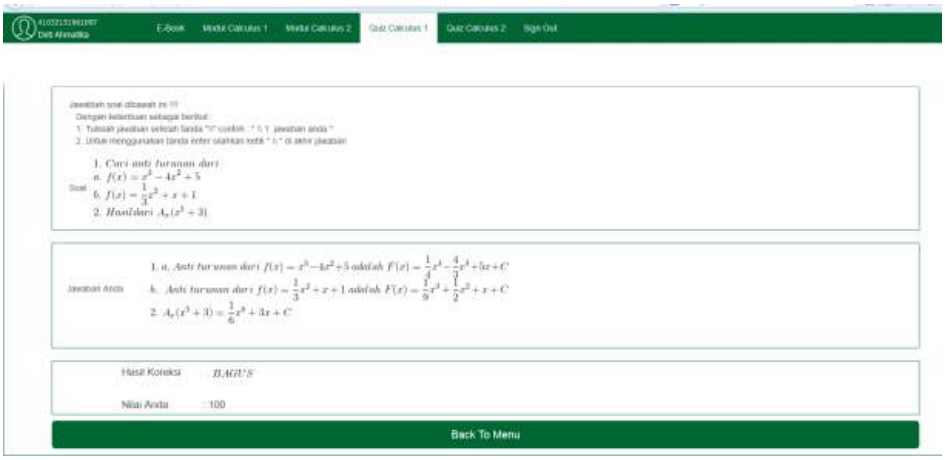

Figure 7: *Example of student's work on online quiz anti-derivative material*

Students do the quiz given by the lecturer based on the schedule. However, lecturer could not monitor whether students work the quiz on time or not because m-learning feature do not provide feature to see students work processing time.

There are some findings based on the implementation of m-learning:

- In mobile use, the chat feature is not maximized thereby inhibiting communication between lecturer and students.
- The material presented by m-learning not fully understood by students, because some of the materials required considerable deepening assisted by lecturers.
- There is no flash feature for certain material to create graphic, determine volume and area of an objects.

- Llimited ccharacter to write equation in doing quiz
- Quiz deadlines cannot be set automatically. Uncomplete mobile facilities in facilitating learning.

5. Conclusion

In this study, term learning refers to mobile learning (m-learning) with the use of cellular phone as the primary device. Cellular phone with Android OS, Windows, and iOS are the main prerequisite in the development of m-learning. Learning begins by downloading the application installed in cellular phone. It continue by browsing the material. Facilities provided by providers are vary, depending on the needs and goals to be achieved. In m- learning process, the students learn the material ordered by the lecturer, who then held online quizzes on each chapter. Students can ask the lecturer directly through calculus messenger and if necessary held face-to-face meeting.

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