Development of an Interactive Analytical Geometry E-Book Model for Independent Learning

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ABSTRACT
This study is an attempt to improve the quality of teaching and learning, especially in the matter of Analytical Geometry in mathematics education courses. This study aims to produce a model of Analytical Geometry material in the form of interactive electronic book (e-book) that was developed so that students of mathematics education department are trained to learn independently which can lead them to have a better competence. This research is a development that includes the following steps: 1) Preliminary Study, which includes identifying learning needs and identifying the characteristics of students and the need of the lecturers; 2) The design and development of products, which includes: (a) identifying the general purpose of learning, (b) analyzing the learning, (c) formulating specific objectives, (d) developing strategies for interactive learning, and (e) preparing the interactive e-book. The identification results of the need for preliminary studies indicate that in general the students are more interested and need some forms of analytical geometry materials using teaching materials in the form of interactive electronic (interactive e-book) that involves themselves in learning. In this research, the developed products in the form of interactive Analytical Geometry e-book is equipped with a guide for lecturers and students, designed and developed systematically by adhering to the principles of learning development.

Keywords: identifying the need, development, interactive e-book, analytical geometry

1. INTRODUCTION
Analytical geometry is a subject that should be studied by students of mathematics education and is one of the important components in the learning of mathematics that must be mastered by future mathematics teachers. In the practice, analytical geometry is still taught conventionally dominated by model of lectures and less programmed exercises. Such learning makes students less independent because they rely too much on lecturers' explanation.

To overcome the obstacles in this conventional learning, learning materials need to be developed as a model that takes into account differences in students' capabilities, supporting the individual and independent learning, and which can lead students to a joyful learning. According to Dick and Carey (1990), the learning materials should be a material that can be learned entirely alone by the learners. That is, the material can provide opportunities for students to learn the material without relying on the explanation of the teacher or lecturer. Good learning also will enable the learners to provide responses, feedback and also to encourage students to practice correctly.

Development of teaching materials in any form, including in electronic form is intended to assist people for learning or facilitate the learners to learn. Therefore, the development process should be based on various theories about people who learn, people who teach and learning activity itself. In other words, the understanding of the people who learn, people who teach and learning activity is a condition for any development activities of learning. Good teaching materials has to provide a device that allows users to see the benefit and use them in practice. Digital teaching materials in electronic form provide opportunities for innovation, although only for small parts of the instructional materials.

According Darmawan (2012), the development of science, technology and information brings changes and new paradigm in learning materials and learning method. The products of technology and information has provided an alternative teaching materials that can be used and accessed by learners in digital form such as e-books. An interactive computer-based learning enables students to learn with a high motivation and interest in operating multimedia systems. Wena (2010) reinforces that learning which can utilize teaching materials with computer media will make the activities of the learning process interesting and challenging for students.

According to Prastowo (2011), an interactive teaching materials are creative, innovative, and adaptive to developments in technology and can make students pleased and comfortable so the learning process can be effective and efficient. According to Hamid (2012), learning requires fun and empowered interaction. Fun and empowering can be run by integrating the principles of education and entertainment (edutainment), so that students feel joyful learning and avoid boredom. The entertainment can be varied, starting from things, tools, or joyful learning activities for students to involve in. Munir (2013) adds, learning using information and communication technologies can assist educators in presenting the material and learners in understanding the material studied. With a fully multimedia teaching
materials including interactive e-book, then the material can be modified to become more attractive, the learning process will develop well and the atmosphere of learning will also be fun.

On the basis of the problem mentioned above, this study then develops materials for lectures on analytical geometry in the form of interactive electronic book (e-book) so that students of mathematics education department are trained to have independent learning and better competence on analytical geometry field. Through such models of materials, students will not only be passive recipients but also determinants of learning for themselves. Such learning is expected to provide a higher motivation since interactive e-book has always been associated with fun, games and creativity.

This study aims to produce a model of analytical geometry interactive electronic book (e-book) that can improve students’ independent learning and competence of the mathematics education program. At this stage, the research aims to identify the initial conditions (the needs of students and lecturers) in designing and developing e-book materials of interactive analytical geometry, which is equipped with guide for lecturers and students.

Model of interactive analytical geometry e-book is important to be developed because: 1) model of interactive e-book field of analytical geometry using the intranet or internet resulting in cultural change of students’ learning, from the classical to the individual / independent, 2) be an attractive learning, ease of learning, and avoid boredom, 3) will be able to overcome the lack of reference material and learning resources analytic geometry is deliberately designed systematically by adhering to the principles of learning development, 4) will facilitate faculty and students in the learning process because material developed is already a ready-made material, 5) to develop the potential and independence of students, 6) it is a form of teaching material that is highly effective and efficient in this day and age, where prices are very high and the paper-paced era in electronic or digital.

2. METHOD

This research is development. Development research is used to develop and test a specific product (Sugiyono, 2013; Borg and Gall, 1989; Plomp, 1997). In this study, the development model used was adapted and modified from the model Plomp (1997) which comprises the steps of (1) a preliminary study, (2) design and product development, and (3) testing and assessment products. Preliminary study covers: (1) identifying the learning needs of students and student characteristics, and (2) identifying the needs of lecturers. Design and development of products, includes: (1) identifying the general purpose of learning, (2) analyzing learning, (3) formulating specific goals, (4) developing strategies for interactive learning, and (5) developing device interactive e-book, which includes: learning material in the form of an interactive e-book guidelines that include guide for lecturers and students. This study is only done at the preliminary study stage (identification of needs), design and product development.

At this preliminary study, the subject of research is students of Mathematics Education University of Islam Malang and University of Wisnuwardhana Malang consisting of 132 people. The data were collected through: (1) questionnaire, (2) review of the literature, and (3) documentation. The data analysis operated quantitative and qualitative approaches. Quantitative analysis with descriptive statistics percentage (Sugiyono, 2013). While the qualitative analysis in this model is an interactive model analysis of three components: data reduction, data presentation, and conclusion and verification, activities conducted in an interactive form with the data collection process as a process (Miles and Huberman, 1986).

3. RESULT AND DISCUSSION

Results of Preliminary Study

The preliminary was done to obtain data of students’ need and characteristics as well as lecturers’ need. The data gathered was then used as a basis of designing and developing the product.

Need can be defined as a gap between what to expect and the real condition (Sanjaya, 2008). Need identification is used to understand the problem so that one can provide a solving problem on it. In this study, the need identification was used to gather information on the process of analytical geometry teaching and learning regarding its problem, the causes, teachers’ preferred teaching technique, and a wayout of interactive e-book presence, etc.

Based on the identification result through need analysis and students’ characteristics, it was found that 64.79% of the students were happy with the course of analytical geometry. Around 69.01% of the students want to learn analytical geometry seriously and improve their learning outcomes. To improve their competence, 69.48% of them suggest the use of various learning model operated by lecturers to avoid boredom. Meanwhile, 98.13% of them prefer a learning model that can encourage their active involvement in the learning process. 53.99% of the students felt the need of incorporating information technology in learning process. Most of them (55.40%) preferred the use of computer media and internet in the learning process. Most them (52.58%) also strongly supported the learning of analytical geometry in the form of electronic e-book which employs computer and internet. 40.38% of them fairly supported, and few of them(7.04%) less supported. When asked why they don’t support the use of computer and internet, the reason is because they have little
knowledge to operate the media. On this reason, they believe that they cannot participate actively in the learning process. The need and preference of the students toward the development of interactive analytical geometry e-book product can be seen from this diagram below:

The result of questionnaire of lecturers’ need indicated that most of them (75%) still dominate the learning process of analytical geometry and put students as the object of learning. Besides, most of them (75%) agreed to develop materials for analytical geometry in the form of interactive e-book.

Form this data, there is ample fact to develop a model of interactive analytical geometry e-book. Although some students may feel difficult on the use of technology, this can still be overcome with a simple operational procedures.

Knowing this, in general, students believe that it is necessary to develop interactive learning materials that involve students in learning. Media which are much interesting for students are computer and internet. This is corroborated by the opinions of Rusman (2012), stating that the computer can stimulate learners to be active in learning and learners preferred internet that can be used positively as a learning tool. But in practice, they will still need the presence of the lecturer, so that the division of roles of lecturers and the material becomes clear (Wena, 2010). By paying attention to these preliminary studies, the development of interactive e-book product is suitable for them (students).

Results of Product Development

Results of a preliminary study on top of the base is used in designing the product. Steps taken in the design of the product are: 1) defining the general objectives of learning, 2) analyzing learning materials of analytical geometry, 3) formulating specific goals of learning analytical geometry, 4) developing strategies for interactive learning.

In determining the general purpose of learning, it is formulated from course outline and the results of preliminary studies. In general, the purpose of this lecture is so that students have sufficient understanding of analytical geometry.

Analysis of learning materials is the process of elaboration of the general behavior toward specific behaviors that are arranged logically and systematically. Analysis of learning material produces a set of procedures applied in the teaching of analytical geometry in the form of identification measures that are relevant for the implementation of the objectives and subordinate skills needed by students to achieve the goal. Analysis of these learning materials produced 6 learning topics, namely 1) coordinate system, 2) straight lines, 3) Circle, 4) Ellips, 5) Parabola, and 6) Hyperbole.

In formulating specific learning objectives, it is detailed form analytical geometry of general purpose and results of the analysis of learning materials. In any purpose, it is formulated into a number of specific objectives.

Results of Product Development

With regard to the result of product development steps, the researchers then develop a product with drafting process arrangement of interactice e-book in the form of materials for leaning accomplished with guide for lecturers and students.

Interactive e-book device of analytical geometry contains a number of subcomponents materials packaged in the form of interactive e-book format EXE (user application). E-book was developed with programs (software): (1) Ebook maker, which provides a variety of features to meet every need e-book author, and (2) Software quiz maker, which is used to create interactive exercises. Besides arranged with the appropriate software, the material in this e-book is laid out in such a way that material of analytical geometry can be more easily mastered by students. The material is packaged in a single device materials with several topics, each topic materials include: (1) objectives, (2) description of the material, and (3) interactive exercises. With the formulation of objectives, learning becomes clear direction and do not deviate. Furthermore, compiled a fairly detailed description of the material, and ended with interactive exercises in the form of exercises that can be done directly by learners on the spot.

Lecturers guide provides guidance to the lecturer of the course on how to use the interactive e-book learning, which contains components: (1) The theoretical study of analytic geometry, (2) learning objectives, (3)
learning scenarios, and (4) instructions for using the interactive e-book. According to Dick & Carey (1990), a guide book for teachers contains a general description of the overall learning process. Guidelines should be presented to the teacher so that they gain a broad overview of the material and how to incorporate the material into a sequence of students’ learning process.

Student guide contains directions to the students on how to use interactive e-book learning which contains: (1) learning with e-book, (2) elaboration of the main points of discussion are to be learned and descriptions supported capacity after completion of the learning program with materials analytic geometry learning through interactive e-book, and (3) instructions for using the interactive e-book. This is in line with what is proposed by Dick & Carey (1990), that the guide contains directives use of all the resources contained in the material. In addition, the book includes an outline of teaching strategies for students, what should they do first, second, third, and so on.

4. CONCLUSION AND SUGGESTION

This research and development study includes phase of preliminary study, design and product development. The preliminary study includes identifying the needs and characteristics of students as well as lecturers. The identification results in the need for preliminary studies indicate that in general the students are more interested and need some form of analytical geometry learning activity using teaching materials in electronic form of interactive e-book that involves themselves in the learning process. Most of the lecturers agree to run the materials are developed into an interactive e-book. The design and product development activities include identifying common objectives, analysis of learning, formulating specific goals, developing interactive learning strategies, and preparing interactive analytical geometry e-book. The product produced in this study is in the form of interactive e-books of analytical geometry, which includes instructions guide for both lecturers and students, which is designed and developed systematically by adhering to the principles of learning development.

Suggestion

In relation to the result of this study, researchers or developers suggest several things: (1) to generate the creativity of students and lecturers, this model is open to be developed by anyone as long as what is developed still boils down to the development of good learning; and (2) other universities that use this model should consider the similarities of environmental characteristics as described in this study.

REFERENCES