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Developing Interactive Analytical Geometry E-book Model to Enhance Students' Valid, Practical, and Effective Independent Learning and Competence at the Mathematics Education Department

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Abstract: ***This study is designed to improve the quality of learning activity in higher education level. This developed an analytical geometry e-book in the form of interactive electronic book (e-book) to improve students' independent learning. Development research model was employed in this study consisting of several steps: (1) introduction, covering analyses on students' need, as well as lecturers ; (2) product development and design, covering: identification of learning objectives, learning analyses, learning goals, developing interactive learning strategy, and interactive analytical ebook draft compilation; and (3) Testing and assessment of the product (model). Overall, the study proved that mostly students are enthusiastic to learn through this product as their engage directly in the process of learning. The products are I the form of (a) interactive ebook draft, (b) lecturer guidebook, and (c) student guidebook, by which these all are compiled based on teaching and learning principles. The result of testing and assessment also confirm that the products are valid, practical, and effective. Students are also successful in the process of learning through the use of this product.***

Keywords: developing, 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 learning mathematics that must be mastered by a prospective teacher of mathematics. In the implementation of analytical geometry is still a lot of learning done conventionally is dominated model of lectures and exercises less programmed. Such learning makes students less dependent for relying too much on lecturers' explanation.

To overcome the obstacles in the conventional learning it is necessary to develop a model that takes into account the learning material differences in the competencies of students, supporting their independent learning, and to facilitate student learning. According to Dick and Carey (1990), learning materials should be an entirely material that can be learned by the learners. That is, the material can provide opportunities for students to learn without relying on the explanation of teachers or lecturers. Good learning also will enable the learners to provide responses, feedback and also to encourage them to practice correctly.

Development of teaching materials in any form, including in an electronic form is intended for assisting students to learn. Therefore, activity should be based on various theories about people learning, people teaching and learning activity itself. In other words, an understanding of people learning, people teaching and learning activities is a condition for any learning development activities. Good teaching materials 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 the 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 have provided alternative teaching materials that can be used and accessed by learners in digital form as an e-book. Interactive computer-based learning is able to cater students with high motivation due to its connection to the multimedia systems. Wena (2010) reinforce the opinion that learning taking the advantage of teaching materials with computer media will make the activities of learning interesting and challenging for students.

According Prastowo (2011), interactive teaching materials should be creative, innovative, and adaptive to technological developments and can make students happy and comfortable so that learning becomes effective and efficient. According to Hamid (2012), learning requires interaction fun and empowering. Fun and empowering it can be run by combining the principles of education and entertainment (edutainment), so that learners feel entertained and not bored easily learn. A form of entertainment that can be objects, tools or forms of activity that make learners feel happy learning activities. 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 instructional materials including interactive e-book, the material can be modified to become more attractive, the learning process will develop well and become a pleasant learning atmosphere.

Having regard to the analysis of the problem, so in this study was developed materials lectures on analytic geometry material in the form of interactive e-book that students trained mathematics education courses to learn

independently and have a better competence in the field of analytical geometry. Through models such materials, students will not only be a passive recipient but also a determinant of learning for himself. Such learning is expected to provide a higher motivation for interactive e-book is always associated with fun, games and creativity.

In general, this study aims to produce a model of electronic book (e-book) interactive analytic geometry that can improve student learning independence and competence of the mathematics education program. Specifically, the study aims to: (a) identify the initial conditions of students and faculty; (b) design and develop three sets of materials, namely: draft interactive e-book field of analytical geometry, guide lecturer and student manual; and (c) to test and assess the draft products (models) e-book interactive analytic geometry. Interactive e-book model is an important field of analytical geometry to be developed because: (1) model of interactive e-book field of analytical geometry using the intranet or internet which resulted in changes in student learning culture, from the classical to the individual / independent; (2) be an exciting learning, ease of learning, and not boring; (3) will be able to overcome the lack of reference material and a source of analytical geometry learning are intentionally designed systematically by adhering to the principles of learning development; (4) will facilitate faculty and students in the learning process because the material developed is already a ready-made materials; (5) to develop the potential and independence of the student; (6) is a form of teaching materials that are 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 a development (development research). Development research is used to develop and test specific product (Sugiyono, 2013; Borg & 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 development of products, and (3) testing and assessment products. Preliminary study, includes (a) identify the learning needs of students and student characteristics, and (b) identify the needs of lecturers. The design and development of products, includes: (a) identify the general purpose of learning, (b) analysis of learning, (c) formulate specific goals, (c) develop strategies for interactive learning, and (d) prepare the draft model of e-book interactive , which include: learning materials in the form of interactive e-book, a guide lecturer and student manual. Testing and assessment of the quality of products made by examining and assessing the validity, practicality and effectiveness of the model (product) produced (Nieveen, 1999).

The subject of research is a student of Mathematics Education at Malang Islamic University and the University of Malang Wisnuwardhana many as 132 people. Collecting data in this study carried out by: (a) questionnaires, (b) literature review, (c) documentation, (d) observation, and (e) tests. Data analysis technique used is the technique of quantitative and qualitative analysis. Quantitative analysis by descriptive statistics and the percentage of paired samples t-test (Sugiyono, 2013) were employed in this study. While the qualitative analysis in this model by using an interactive model analysis of three components: data reduction, data presentation, and conclusion and verification, whose activities conducted in an interactive form with the data collection process as a process (Miles & Huberman, 1986).

3. Results and Discussion

Preliminary Study Results

Activity pilot study was conducted to collect data identifying student needs and identify the characteristics of the student and faculty needs identification data. Data collected from a project to identify needs and identify the characteristics of the student and faculty needs identification data is then used as a basis in the design and development of products.

Needs (need) is the gap between what is expected with the actual conditions (Sanjaya, 2008). Identification is used as a tool to identify problems in order to determine the appropriate action. In this study, the identification of needs was conducted to obtain information from students about the lecture analytical geometry during this time, if there is a problem, what causes it, is the way in which the lecturer had been favored, and what is the way out the provision of material in the form of e-book interactive is something required, and so on.

Based on the results of questionnaire analysis needs and character of the 132 students showed that 64.79% of students happy with the course of analytical geometry. Approximately 69.01% of the students want to learn analytical geometry it seriously and try to improve learning outcomes. To improve their competence, 69.48% students want lectures models used lecturers varies greatly so that students do not feel bored in learning. While 98.13% students want a model that encourages college students are actively involved in the learning process. There are 53.99% of the students were delighted when lectures take advantage of information technology. The majority (55.40%) students want learning to use computers and internet media. If the material in the course of analytical geometry shaped electronic interactive books that utilizes a computer and / or internet, the majority (52.58%) students were very supportive, some of them (40.38%) support, and a small portion (7.04%) less support. As confirmed at those who are less supportive, because most of them lack reasoned master information technology (IT), so that they could not follow the lectures worried well.

From the results of the questionnaire needs of lecturers shows that the majority (75%) lecturers in teaching analytical geometry still often dominates in learning by placing students as the object of study, but the majority (75%) lecturers expressed support when teaching material eyes analytical geometry arranged with a form e -Book interactive.

With this kind of data, means sufficient reason for the development of interactive e-book model of analytic geometry. While it seems there is little constraint on students who are less proficient in computer technology, but this can

be overcome with the development of e-books that are not too complicated operation.

Noting this, mostly students are of the opinion that it is necessary to develop interactive learning materials that many engage them in learning. The most interesting medium for the students is a computer and internet. This is corroborated by the opinions Rusman (2012), that computer can stimulate learners to be active in learning and internet favored the learners that can be used positively as a learning tool. But in their later implementation still needs the presence of professors, lecturers so that the division of roles and the material becomes clear (Wena, 2010). Having regard to preliminary studies, the development of interactive e-book product is suitable for them (students).

The results show that the identification of the characteristics of student attitudes, interests, and motivations of students in general good of the material analytic geometry. It will support the success of the product to be developed. Characteristics as seen from the attitude of students who strongly supports the development of e-book interactive analytic geometry will facilitate and assist researchers in formulating and implementing product development.

Results of Product Design

Results of preliminary studies on the above basis were used in designing the product. The steps taken in the design of the product are: (1) define the general objectives of learning; (2) analyzing analytic geometry learning materials; (3) to formulate specific goals of learning analytical geometry; (4) develops interactive learning strategies.

In determining the general purpose of learning, formulated from Events Unit Class (SAP) and the preliminary study. In general, the purpose of this lecture is students have a sufficient understanding of analytical geometry.

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

The specific goals of learning of analytical geometry are derived from the analysis of learning materials.

The development of interactive multimedia learning strategies still considers lecturers' presence. Therefore, the study was well designed involving faculty members and students (Wena, 2010). Interactive strategy is chosen as an appropriate way to develop a product. On the development of this product, learning activities are well structured and arranged.

Results of Product Development

With regard to the outcome measures product design, further product development with the process of the drafting of interactive e-book devices, which include: (1) the study materials in the form of interactive e-book field of analytical geometry; (2) guide lecturer; and (3) the student manual.

EBook device interactive analytic geometry, contain a number of subcomponents materials are packaged in the form of interactive e-book format EXE (application). E-book was developed with programs (software): (1) Ebook maker, which provides a variety of features to meet every need of e-book author, and (2) Software quiz maker, which is used to create interactive exercises. Besides, completed with the right software, the material in this e-book is arranged based on material analytic geometry which can be mastered by students. The material is packed in a single device materials with several topics, each topic materials includes: (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 ending with interactive exercises in the form of exercises that can be done directly by learners on the spot.

Free lecturer unbiased guidance to the lecturer of the course how to use interactive e-book learning, which contains components: (1) The theoretical study of analytical geometry, (2) learning objectives, (3) learning scenarios, and (4) the instructions for use e- interactive book. This is in line with the stated Dick & Carey (1990) that the handbook for teachers contains a general description of the overall learning process. Free should be presented to the teachers so that he gained a broad overview of the material and how to incorporate the materials into the learning process sequence.

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

Results of Testing and Assessment Product (model)

Testing and assessment of the quality of products made by examining and assessing the validity, practicality and effectiveness of the model (product) produced. Testing and assessment of the validity of the products were made by expert of instructional design, multimedia learning expert, and content expert analytical geometry. Rate the validity of the products made by experts over the validity of the assessment questionnaire instrument products. The results of the analysis of the product validity assessment by experts obtained an average score of 3.48 (height). From these

scores show that the model of interactive e-book produced qualified validity of the model.

Testing and assessment of the practicality of the product were made by the four practitioners (lecturers) teaching analytical geometry from different universities. The results of the analysis of the practicality of the product assessment obtained an average score of 3.26 (height). From these scores show that the model of interactive e-book produced qualified practicality of the model. Interactive e-book model of analytic geometry has been tested by four users (practitioners) or lecturer analytical geometry. Through questionnaires, the users (practitioners) states that the model is attractive and may be used or implemented in the course of analytical geometry. This is in accordance with the opinion of Nieveen (1999) that a model is said to be practical if the user (practitioner / lecturer) looked at the model developed interesting (fun) and may be used or implemented in learning.

Testing and assessment of the effectiveness of the products is done through a trial with a design student pilot quasi experimental group pretest-posttest pairs (matching pretest-posttest group design) and student assessment product users through questionnaires. Tests performed on a group of students amounted to 74 people, with paired samples. Prior to testing the product on the student, the student is given the initial test (pretest) and then after trying the product by the students and then the students were given a final test (posttest). Requirements that must be met before the t-test is normally distributed data (Sugiyono, 2011; Sukmadinata, 2012). Normality test results data using P-P Plot in SPSS 19.0 shows that the data has been berdistrubusi normal. Data analysis was performed with SPSS 19.0, the value of the average pretest was 62.27 and the average value of the post-test was 73.48. Results of paired samples t test (paired sample t test) obtained by value t = -7.25 with a significance level of 0.002 and t value is smaller than 0.05 which means that Ho refused or there are differences in the average value of the pre-test and post-test students (Santoso, 2009). From these results indicate that the use of interactive e-book of analytical geometry can improve student learning outcomes.

The results of student assessment to products that have been tested through questionnaires obtained an average score of 3.16 (good / high). Of student assessment of the product, in general the students agreed or looked good against the use of interactive e-book model of analytic geometry in lectures. From the results of testing the effectiveness of the product through trials with quasi experimental and student assessment product users through questionnaires obtained good results. These results indicate that the model of interactive e-book produced qualified effectiveness of the model. This is in accordance with the opinion of Nieveen (1999) that a model is said to be effective if operationally the model provides results as expected, namely to achieve the learning objectives with good results (the study of students show good learning outcomes and response / assessment of learners well to the implementation of learning).

Testing and assessment of the quality of this product in accordance with the theory Nieveen (1999) that the development model of a proper assessment of the quality of products (models) to test and assess the validity, practicality and effectiveness of the model (product) produced.

4. Conclusions and Recommendations

In this research includes the development of a preliminary study phase, design and product development as well as testing and judging of products (models). In a preliminary study includes identifying the needs and characteristics of students and faculty needs. Preliminary study results show that in general the students are more interested in analytical geometry lectures that use electronic teaching materials in the form of interactive (interactive e-book) that involve themselves in learning. Most lecturers expressed support when the eyes of analytic geometry teaching materials prepared interactive e-book form. Design and product development activities include learning to identify common objectives, analysis of learning, formulate specific goals, the development of interactive learning strategies, and the preparation of interactive e-book devices in the field of analytical geometry. Product generated in this study are (1) e-book interactive analytic geometry, (2) guide lecturer, and (3) guide the students, who designed and developed systematically by adhering to the principles of learning development. From the results of testing and assessment products, it can be concluded that interactive e-book results of analytical geometry are valid criteria, practical and effective. Results of student learning in the field of analytical geometry by utilizing interactive e-book can be managed better.

Relating the results of this study, the researchers 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 teaching; and (2) for wider utilization to other universities should consider similarities environmental characteristics as described in this study.

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