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Development of Mathematical Learning Materials with Constructivism Approach Using Mobile Learning System

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Abstract

This research aims to produce learning materials learning math with constructivism approach through mobile learning system. This research is research development. Development methods used follow the 4-D model of the stage define, stage design, develop and disseminate stages stage. On the research focused at the third stage i.e. develop. The subjects in this study are students of mathematics education courses the University Bung Hatta 2015 forces totaling 26 people. The results obtained from studies on stage develop this is learning materials have been produced using mathematical constructivism approach through Mobile Learning System a valid and practical. Overall excess materials this is student accessible online through the browser the browser on a Laptop, Smartphone, or Computer with the address of www. yusriwahyuni. xyz and also can be displayed offline after learning materials in this Download. Students can measure the level of his own understanding towards the subject matter by way of doing evaluation and see the results of the evaluation that they are working on. In addition students can also repeat or continue his studies back at home independently and more fun.

Keywords: Develop; Teaching materials; Constructivism approach; Mobile learning system.

1. Introduction

To optimize the learning process required the creativity of teachers or lecturers in the selection and use of learning resources in accordance with the development and the need of students. One of the means to support the learning process is teaching materials. Lecturers can create teaching materials that are appropriate to the characteristics of students, by approaching to help the students constructing their own knowledge, so that knowledge can grow and develop in the mind of the students because they construct the knowledge themselves.

The approach that can be used to support students in constructing their own knowledge is the constructivism approach. According to Ovelyn *et al.* (2013) in a constructivism approach knowledge can not be transferred from teacher to student, but students must build their own knowledge so that learning becomes meaningful.

Reality in the field based on the first survey, teaching materials of mathematics that exist is less support the efforts of lecturers to develop student potential optimally. Along with technological developments, the learning process of mathematics needs to be carried out creatively and innovatively by utilizing emerging technologies. Therefore, the design of mathematics learning based on constructivism approach can be done by using multimedia, so that the learning of mathematics becomes more meaningful (Esra and Bern, 2010).

Trending multimedia is one of them, that is a new trend in the world of e-learning, known as mobile learning system, the use of portable media such as Smartphone, IPhone, and PCTablet to access online learning system is often discussed and used in developed countries such as the United States and developing countries , not least in Indonesia.

The use of mobile learning system as a supporter of teaching and learning process is supposed can add flexibility in learning activities. With mobile learning system which is one alternative that service learning should be implemented wherever and whenever Darmawan (2012). Mobile learning system can be applied wrong on Android which is now a trend in smartphone applications.

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This is in line with Sukiman. (2011) that learning media can be used to share the message from the sender to the recipient so as to stimulate the thoughts, feelings, interests and interests and willingness of the students in such a way that the learning process occurs in order to achieve the learning objectives effectively. Mobile learning system is chosen as one of the learning service, because it also has several advantages compared to other learning such as can be used anywhere and anytime, most portable media moves have relatively cheaper price compared to desktop PC

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price, small and light material size than PC desktop, and is expected to include more students as the mobile learning system utilizes the technology commonly used in everyday life (Tamimudin, 2007)

The purpose of this research was to produce mathematics teaching materials with constructivism approach through a valid and practical mobile learning system.

Based on the description, the development of learning materials of mathematics with constructivism approach through mobile learning system is very important to be implemented. The problem to be answered was how the form of mathematics teaching materials with constructivism approach through mobile learning system valid and practical.

2. Literature Review

2.1. Teaching Materials

Learning materials as all material (either information, tools or text) that are arranged systematically, which shows the figure of the whole of the competencies will be controlled by the learners and are used in the process of learning with the aim of planning and implementation of learning reviewers. The materials include information sources, tools and text required teachers in presenting the materials and skills that students should have (Yin, 2003). Information sources the material and this activity consists of a set of systematically arranged material both written and unwritten so created the environment or atmosphere that enables students to learn (Levin, 2008) . According to the (Goudas, 2006) to add to the experience of the students, the teacher should always be active and creative role as facilitators that inspiring. Learning materials contains facts, concepts, principles and procedures that are relevant, written in the form of points corresponds to the formulation of indicators of achievement and competence.

2.2. Constructivism Approach

Confrey and Kazak (2006) stated that constructivism learning theory has implications towards the learning of mathematics, namely learning math helps students to construct math concepts with its own merits through the process so the concept of internalization, it woke up again through the transformation of the information to be a new concept.

Based on the views of the House of Constructivism is not the activity of moving knowledge from teacher to student, but rather an activity that allows students to build their own knowledge (Martinis, 2008); (Nur, 2000) revealed that the task of the educator not only pour a certain amount of information into the minds of students, but how to animate important concepts and very useful embedded firmly in the minds of students.

2.3. Mobile Learning System

Mobile learning is a technology that uses the telephone network to facilitate, support, improve and expand the range of learning (Kalloo and Mohan, 2012). By using mobile learning students can access learning materials anywhere any time (Farrah *et al*., 2015) .

With mobile learning system which is one of the alternatives that the service learning should be implemented wherever and whenever (Darmawan, 2012). In other words, the mobile learning system is learning that make use of mobile as a media study can be carried out wherever and whenever so pembelajararan can take place effectively. It is in line with the (Sukiman., 2011) learning that the media can be used to transmit a message from the sender to the receiver so that it stimulates thoughts, feelings, concerns and interests as well as the willingness of the students in such a way so that the process of learning occurs in order to achieve learning objectives effectively.

Mobile learning system selected as one of service learning, because it also has some advantages compared with other learning can be used wherever and whenever it is used, most portable media moves It has a relatively cheaper price than the price of a desktop PC, the size of a small and lightweight materials than desktop PCs, and is expected to be able to include more learner because mobile learning system utilizing technology that ordinary used in everyday life (Tamimudin, 2007).

3. Methodology/Materials

This research included the type of R & D (research and development) or type of research development. The development was the development of instructional materials with constructivism approach through Mobile learning system.

In the learning materials development procedure using modification of 4-D model (Four D model) from Thiagarajan which consists of: a) define, b) design, c) development, d) disseminate.

Activities conducted at this stage define are front-end analysis, learner analysis, topic / material analysis, task analysis and formulating specific learning objectives. At the stage of design, designed learning materials for mathematics with be constructivism approach, paying attention to the suitability of the materials as well as the look and design of the materials. The designed learning materials can be opened using a mobile phone using the internet network.

In this article which was focused on the third stage of development (develop). The design of the activities performed on the stage of development is to validate the learning materials. Once validated, researchers developed a draft of the product that include preparation of learning materials, learning, and evaluation instruments. Activities conducted in preparation of learning materials is revising the learning media assessment, based on the comments and suggestions of the validator. While the process of learning plan based on the evaluation of instruments of the semester.

4. Results and Findings

4.1. Development of Product Draft

The purpose of this stage was to produce a revised learning draft tool based on expert input and data obtained from field trials. Activities at this stage include device Validation by experts followed by revision and field trials with actual students. Expert judgment aimed to obtain suggestions, criticisms used as input to revise learning tools (draft beginning / draft I) so as to produce draft II. In this expert judgment stage can be done repeatedly so that improved device is obtained. The expert's judgment was mainly to examine the correctness of concepts, legibility, and suitability to support teaching and learning activities.

After the learning media was validated by the validator the author develops the product draft (the initial product) which included the preparation of learning materials, the learning process, and the evaluation instrument. Preparation of learning materials is to revise the learning media based on assessment, comments, and suggestions from the validator. While the learning process and evaluation instrument based on Semester Learning Plan.

4.2. Analysis of Validation Result of development of Learning Materials

Based on the validation that had been done by four validators consisting of two lecturers of mathematics education and two lecturers of informatics and computer education, obtained information that validation of mathematics teaching materials with constructivism approach through mobile learning system had been implemented 2 times where starting with the draft 1 which is validated by all four validators. Based on the suggestion and comment of validator then the authors improved the learning media that the authors develop to become draft 2. After that draft 2 validated back by 4 people validator, in this second validation stage validator had stated that mathematics teaching materials with constructivism approach through mobile learning system author develop well and can be used as teaching material in learning without revision.

4.3. Validity of Mathematics Teaching Materials with Constructivism Approach Through Mobile Learning System

Validity test of teaching materials assisted by 4 experts consisting of two lecturers of mathematics and two lecturers of informatics and computer engineering. The description of validation process done was Validator I, II, III, and IV have to test the validation of teaching materials with constructivism approach as much as 2 times. In the first validation of teaching materials that the authors develop had a lot of criticism and suggestions that must be improved. In this first validation the product that the authors developed was not good enough and can not be used and still require consultation. On the validation of both teaching materials that the author developed had been declared good and can be used without revise.

4.4. Limited Trial of Mathematics Teaching Materials with Constructivism Approach Through Mobile Learning System on Basic Geometry Course with Material Surface Area and Volume of Geometry Course

After mathematics materials with constructivism approach through mobile learning system which the author developed had been declared eligible by four validators, the authors do initial field trials and fill questionnaires practicality test. Based on the result of questionnaire of practicality test obtained, it was known that student response to mathematics teaching materials with constructivism approach through mobile learning system get positive response above 80% in every aspect

Viewed from ease of use aspect, mathematics teaching materials with constructivism approach through mobile learning system categorized easy to use by students with a positive response rate of 93.44%. This showed that this resource was easy to access, the instruction was easy to understand, the material presented was clear and simple, the language used was also easy to understand, and the size and font were comfortable and easy to read.

If seen from the aspect of time effectiveness, mathematics teaching materials with constructivism approach through mobile learning system is effectively categorized used by students with a positive response value of 91.6%. This shows that the illustrations shown on the mathematics learning website with constructivism approach through mobile learning system make them more quickly understand the material. In addition, the animation contained in teaching materials to help students understand the problems contained in the question.

From the aspect of attractiveness and benefits, mathematics teaching materials with constructivism approach through mobile learning system were categorized as interesting and useful to be used by students with positive response value of 92.7%. This showed that the mathematics teaching materials with constructivism approach through mobile learning system interesting both in terms of illustration or animation were displayed. In addition, this instructional material was also very useful because it helps students to study independently, the steps of problem solving were presented clearly and easily understood, the questions given make the students trained in problem solving, and evaluation that can measure the level of student understanding. In addition, mathematics teaching materials with constructivism approach through mobile learning system can increase students' interest and motivation to learn, and students also felt happy to learn using mathematics teaching materials with constructivism approach through mobile learning system.

Although the mathematics material with constructivism approach through mobile learning system still needs improvement, but based on the analysis of validation result and the result of questionnaire test of practicality test it

can be concluded that the mathematics teaching material with constructivism approach through mobile learning system is good quality and can be used as teaching material mathematics in the learning process.

Overall the advantages of this resource was accessible to students online through the browser on Laptop, Computer, or Smartphone with the website address www.yusriwahyuni.xyz and also can be displayed offline after the instructional material was downloaded. Students can measure their own level of understanding of the subject matter by way of evaluation and saw the results of their evaluation. The average value of the results of the evaluation obtained by the students at the time of product trial of 83.2. In addition students can also repeat or continue their studies back at home independently and more fun.

4.5. Analysis of Practical Questionnaire Results

Based on the questionnaire results of practicality that has been filled by 25 students of mathematics education courses that take the course of geometry, then obtained the data as follows:

Table-1. Praticality Questionnaire Result

No	Aspect	Scoring					The Number of Response	Highest Score	Response percentage
		1	2	3	4	5			
A	**Ease of Use**								
1	This teaching material is Easy to Acces	0	0	0	6	19	119	125	95.20%
2	This teaching material has guidline	0	0	0	7	18	118	125	94.40%
3	This teaching material is clear and simple	0	0	0	10	15	115	125	92.00%
4	The language used is understandable	0	0	0	9	16	116	125	92.80%
5	The font size and kind is easy to read	0	0	0	9	16	116	125	92.80%
B	**Learning Time Effectivity**								
1	The illustrations in this material make me more quickly understand the material being taught	0	0	0	11	14	114	125	91.20%
2	The animation shown makes me understand the problem more quickly	0	0	0	10	15	115	125	92.00%
C	**Attraction and Benefits**								
1	The illustrations shown help me in understanding the subject matter	0	0	0	10	15	115	125	92.00%
2	The animation showed is attractive	0	0	0	10	15	115	125	92.00%
3	This teaching material helps me to study independently	0	0	0	7	18	118	125	94.40%
4	The problem solving steps displayed are clear and easy to understand	0	0	0	11	14	114	125	91.20%
5	The problems contained in teaching materials make me more trained in solving problem	0	0	0	10	15	115	125	92.00%
6	The evaluation contained in the teaching materials helps me measure my level of understanding of the material	0	0	0	7	18	118	125	94.40%
7	These teaching materials increase my interest and motivation to learn	0	0	0	10	15	115	125	92.00%
8	I love learning to use this teaching material	0	0	0	8	17	117	125	93.60%
Response Percentage							**1914**	**2000**	**95.70%**

Response data from student on the product was analyzed and calculated using the formula:

$$Percentage\ of\ response = \frac{Number\ of\ student\ responses\ each\ aspect\ that\ appears}{Highest\ score}\ x\ 100\%$$

.

Response is said to be positive if students who respond positively to each learning component are $\geq 80\%$.

Based on the data in Table 1 can be seen that the percentage of students that positively response to mathematics teaching materials with a constructivism approach through Mobile Learning System was more than 80% so no improvement. So far the teaching materials produced there are no obstacles. Some of the comments from the students were not the least that the material was interesting and helps the students in understanding the material presented.

Overall, mathematics teaching materials with constructivism approach through mobile learning system got positive response above 80% that was 95,70%.

5. Conclusion

Based on the result of the research, it can be concluded that the result of the development of mathematics teaching materials with constructivism approach through mobile learning system in Geometry course with Surface

Area materials and Volume of Geometry , it means the teaching materials as a learning tool and student response to this teaching material is positive.

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