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Development of mobile learning with constructive models in trigonometry material at senior high school 8 in Semarang

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ABSTRACT: This research is motivated by the non-optimal increasing use of smartphones among students with the aim of developing a mobile learning media on the subject of trigonometry using a decent constructive model for an interactive and effective mathematical teaching process. Data were effectively analyzed using the Research and Development (R&D) methods with the Borg and Gall model. The product showed that the effective criteria of the experimental class learning achievement were better than the control class using the t-test. The obtained t count> t table is 2,09 > 1.67. Therefore, Ho is rejected, which means learning using media mobile with the constructivist model is better than the conventional. Therefore, it is concluded that mobile learning media with the constructivist model is an effective learning process for senior high school students.

Keywords: Constructive Model, Conventional Model, Mobile Learning

1 INTRODUCTION

1.1 *Background*

In the globalization era, the development of Science and Technology is rapidly developing. According to data from International Data Corporation (IDC), a market research institute, sales growth in 2014 for smartphones and tablets grew by 12% and 18%, respectively, compared to 2013. In Southeast Asia, Indonesia is the biggest contributor to its sale with a 30% increment. Sophisticated technology tends to encourage its use in the teaching and learning process, to maximize student outcomes.

Mathematics is a subject taught at every educational level in Indonesia, starting from elementary to college. It needs to be given to equipping them to think logically, analytically, systematically, critically, and creatively, with the adequate corporation. Many students still find it difficult to absorb the materials taught by teachers in accordance with concepts and formulas. This tends to be an obstacle, which makes them lose interest in studying the subject. Students seem quiet and lack interaction with teachers during the learning process, thereby making it difficult to use the material to achieve the required objectives. One way to overcome the increasing problems is by improving the delivery method using media containing text, images, videos, animations, and sounds, which tends to foster their interest in mathematics.

The teacher plays an important role in the learning process. Therefore, they need to be innovative and creative in using technology to facilitate their understanding of mathematics. Teachers as facilitators are required to be able to present current technological material to make learning more effective and efficient using the media, which are now developing along with the era of globalization.

The smartphone is a learning media, with the ability to facilitate and increase students' interest in learning through characters and visuals designed. According to Kumar, in 2013, mobile learning, also known as m-learning, is conducted using a small or portable computing

device, which enables users' to access learning content anywhere, irrespective of the time and place (Kumar, 2013).

Abu bakar and Rahmat syah (bakar and Syah, 2012) argued that learning is more directed at the formation of meaning based on prior knowledge and understanding. In this process, students are actively involved in discovering the meaning of what they are learning in order to create a direct impact on the growth and development of their thinking skills. This is capable of building cognitive knowledge in students independently to enable critical thinking in solving problems related to mathematics.

Based on the research of constructivist models conducted by Cakir (Cakir, 2008) entitled "Constructivist Approaches to Learning in Science and Their Implications for Science Pedagogy: A Literature Review," it is concluded that students need to have the basic knowledge to enable improve the learning process. This contradicts the research conducted by Khalid and Muhammad (Khalid and Azeem, 2012) entitled "Constructivist Vs. Traditional: Effective Instructional Approach in Teacher Education," which concludes that constructivist groups mark higher satisfaction and increase students' participation in learning. They tend to be more willing to answer and ask questions in order to clarify the material and group discussion, which results in the introduction of many new points.

A research conducted by B-Abee Toperesu and Jean-Paul Van Belle: 2018 (Abee and Jean, 2018) titled "Mobile Learning Considerations In Higher Education: Potential Benefits And Challenges For Students And Institutions," showed that the use of mobile learning in higher institutions, as acts as a reference. The research carried out by Jin Xue et al., 2018, (Jin, Xue and Heng, 2018) titled "Effects of Mobile Learning on Academic Performance and Learning Attitude in a College Classroom" showed that mobile learning makes students independent and more active.

The above descriptions illustrated the importance of developing interesting, innovative, effective, and efficient learning media, capable of fostering students' interest.

1.2 *Problem formulation*

Based on the background described above, the subjective problems associated with this study lies on the question: "Is the learning outcomes using mobile media with a constructivist model better than the conventional trigonometry in class X high school?"

1.3 *Research objectives*

The purpose of this research and development is to determine if the learning outcomes of mathematics using constructivist models are better than the conventional method using trigonometry material.

2 RESEARCH METHODS

This research was conducted at Senior High School 8 in Semarang from February to June 2018, with data collected from class XA and class XB. The instruments used were 20 multiple choice test questions with a 90-minute time allocation. Before evaluation, the test questions were tested in the trial class (X C) to ensure the test questions met the requirements of validity, reliability, level of difficulty, and good distinguishing power. In addition, the questionnaires were given to material and media experts.

Furthermore, this study utilized the Borg and Gall model comprising of 10 stages as its research design by using only 6 stages, namely (1) Potential and problems, (2) Data collection, (3) Product design, (4) Design validation, (5) Design revisions, (6) Product testing. The test technique was in the form of multiple-choice Trigonometry materials using sine and cosine rules, which are then analyzed using the normality (Lilliefors test), homogeneity test (two variance similarity test), and the right t-test samples. The effectiveness of the results determines

the indicator and completeness of the value of each individual learning outcome to analyze the results of the average experimental and control class.

3 RESEARCH RESULTS AND DISCUSSION

Based on the research conducted, the results of the evaluation on media experts are based on 85% learning presentation, 80% language, and 80% graphic feasibility aspects. While the results of evaluations on material experts are 100% general aspects assessment, 100% material substance, and 95% learning design aspects. From the evaluation results on material and validation experts, the average score was 88.57%; therefore, it is concluded that mobile learning media with valid constructivist models is used in the classroom.

Furthermore, it is tested based on effectiveness, using the hypothesis test t one side of the right, the following an average evaluation table of the control and experimental classes.

Based on the table above it is known that the average results of the experimental and control classes are 79,13 and 75,25, respectively, with n1 = 40, n2 = 40 and s-total

Table 1. Average results evaluation of the control and experimental classes.

Class	Average	Total of students	Lcount	Fcount	Varians total	tcount
Control	75,25	40	0,1379	1,28	8,17	2,12
Experiment	79,13	40	0,1061			

= 8,17, while the normality test in the control class is obtained L count = 0,1379 < L table 0,1401 and normally distributed. The experimental class obtained L count = 0,1061 < L table 0,1401 therefore, the experimental class is normally distributed. Furthermore, to test the homogeneity of the two classes using the F test, F count = 1,28 <Ftable = 1,76; therefore, it is concluded that the two classes are homogeneous. The last step is to test the hypothesis using the right-hand t-test, from the two classes t count = 2,09. The results from the distribution list t and dk = 78 and when t 0,95 (78) is 1,67. Therefore, from the calculation t count and t table equals 2,09 and 1,67. Ho is rejected because t count > t table which is 2,09> 1,67.

Based on the calculation of effective criteria using SPSS, it is concluded that Ho is rejected with t count> t table which is 2,09 > 1,67 and the experimental class > control by 79,13 > 75,25, with a Minimum completeness criteria value of more than 75 the learning outcomes using mobile media with constructivist models are better than conventional with trigonometry in class X high school.

4 CONCLUSION

Based on the discussion of the problem, the following is concluded:

1. Mobile learning media developed products with constructivist models in the form of e-book applications using trigonometric for X grade students of high schools.
2. Learning outcomes using mobile media with constructivist models are better than conventional models using trigonometry.

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