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Development of geometry materials based on scientific approach for junior high school students

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Abstract. A scientific approach is a learning process designed so that learners can actively construct concepts, encourage learners to find out from various sources through observation, and not just be told. Therefore, learning by scientific approach offers a solution, because the goals, principles, and stages of the scientific approach allow for a good understanding of the students. Because of the absence of teaching materials “polyhedron geometry based on scientific approach” which is widely published in Indonesia, then we need to develop the teaching materials. The results obtained in this study are the tasks presented on teaching materials with a scientific approach both in defining the cube and the beam, identify and solve problems related to the properties and elements of cubes and beams, making cube and beam nets, solving problems related to cube and beam nets, solving problems related to cube and beam surface area. Beginning with the difficulties students face. Then, based on the results of interviews with teachers and analysis of student difficulties on each indicator, researchers revise the teaching materials as needed. Teaching materials that have not found any more student difficulties then the teaching materials are considered valid and ready for use by teachers and students.

1. Introduction

Curriculum in Indonesia today is sufficient to achieve mathematical ability, but still, the teacher plays a key role in the achievement of this matter. As Suryadi [1] said to achieve the competencies set in the curriculum, teachers are required to describe teaching and learning activities in the form of teaching planning. Because teaching materials are important tools that play a role in learning and thinking activities, the lack of meaningful teaching materials used by teachers is a problem in learning mathematics in the classroom.

According to Junior High School Mathematics Teachers who attended the PLPG in 2009 Rayon 037 and Rayon 035 from Jakarta and several Level II Regions in West Java (Bogor Regency, Bogor City, Sukabumi District and Sukabumi City), the most difficult material for students They are the matter of building a flat side room. Learning difficulties experienced by students is the lack of imagination and spatial ability of students to components wake flat so that students are less able to understand the concept given. In other words, students find it difficult when drawing or painting and making a mathematical model of the problem of waking up space. Meanwhile, painting plays an important role in the learning of geometry in schools because geometry paintings connect between physical space and theory. If in the area of Jakarta and West Java which in terms of educational facilities are more advanced than other regions, certainly not closed the possibility of difficulties are also felt in other areas of Indonesia.

To counter this, the scientific approach offers a solution. Learning with this approach has succeeded in improving learning outcomes in some primary and junior secondary schools in Indonesia, this can be seen in the research [2,3,4]. Based on some of the studies already mentioned, perhaps a scientific



approach can also be used to improve students' learning outcomes in junior high schools especially for building a flat side room.

In order to implement a flat space based on a scientific approach, it is necessary to prepare a scientifically based teaching material that is currently not widely publicized. Therefore, the authors feel the need for an innovation of learning mathematics through the preparation of teaching materials to help students in understanding the material of building a flat side space. According to the 2013 curriculum that uses a scientific approach, the teaching materials are prepared according to the scientific approach. This research is very instrumental in the development of mathematics teaching materials, especially teaching materials based on a scientific approach. Because the scientific approach is a learning process designed in such a way that learners actively construct concepts, encourage learners to find out from various sources through observation, rather than just being told, so we need to develop their own scientifically based teaching-based teaching materials Junior high school students. This research is very important for the innovation of Indonesian mathematics learning so it is expected to become the basis for the development of interesting teaching materials for other materials in junior high school.

Based on the background of the problem and the scope of the research, the research formulation of this issue is "Development of Instructional Materials to Build a Flat Space Based Scientific Approach for Junior High Schools".

2. Methods

2.1 Place and Time of Research

This research was conducted in MTs. Islamiyah Ciputat Jl. Kihajar Dewantara No. 23 Ciputat, South Tangerang in the first semester of the academic year 2016 / 2017 dated October 4, 2016, to November 3, 2016.

2.2 Research Procedure

This research is a development research whose product is a worksheet for three-dimensional material based on the scientific approach which will be used in MTs. Islamiyah Ciputat. Student worksheet developed the student textbook in the form of a collection of Student Worksheet. The development of this student worksheet refers to the model of development of the general teaching materials from Tjeerd Plomp [5] consisting of several phases namely (1) early investigation phase (identification of learning obstacle), (2) design phase, (3) realization, and (4) Test phase, evaluation, and revision.

2.3 Instrument Development

There are 2 instruments developed in this research, namely: validation sheet and student worksheet.

3. Results and Discussion

3.1 Instrument Development Results

Prior to use, the instrument was validated first by one lecturer in Mathematics Education from University Semarang, one Mathematics teacher from MTs. Islamiyah Ciputat Based on the results of validation that has been done, the instrument that the researchers designed to use without proper revision.

3.2 Description of Interview Results with Teacher

Interviews with grade 9 teachers are conducted to find out the difficulties students experience in studying three-dimensional space materials based on their experiences in teaching. Based on the teacher's narrative, the weaknesses of the students are the first lack of imagination to imagine the three-dimensional castings component, so that the students are less able to understand the concept given. In other words, students find it difficult when drawing or painting and making a mathematical model of the problem of waking up space. And second, students find it difficult to work on a problem with a different context.

3.3 Hypothetical Learning Trajectory (HLT)

Hypothetical Learning Trajectory (HLT) is a series of lesson planning based on anticipation of the possibility of student mindset in learning to develop the purpose of spreading. HLT consists of three components, namely learning objectives, learning activities, and learning process hypotheses are predictions about the mindset and understanding of students organized in the context of learning activities. Based on the results of interviews with grade 9 teachers, interviews with an analysis of answers on the students' initial ability tests, HLT was prepared as provided in the appendix.

3.4 Experiment

The teaching materials that have been compiled are then tested to students in the 9th grade. Students work in groups, one group consists of 2-3 people. Each group gets an LKS. In this LKS there is the main task and the task of strengthening. All tasks are related to three-dimensional spaces. Students are given guidance in advance before working on teaching materials in the hope that students do not have difficulty in working on this resource. Student experiences and responses occurring during this phase will be collected as a reference in the improvement or modification of HLT for further learning.

3.5 Analysis of Student Difficulties in Initial Capability Test

The written test is done to find out the difficulties experienced by students in working on problems related to waking up the flat side space by paying attention to the indicator of material space dimension three. Here is an analysis of the difficulties experienced by students in answering each item given in accordance with the indicator.

3.5.1 Define cubes and beams

The difficulties students face on this point are: (1) to the Student does not understand the definition of a flat side room, as evidenced by the 12 groups working on the LAS, 7 groups cannot answer; and (2) build a flat side room where students are focused only on cubes.

3.5.2 Identify and resolve problems related to the properties as well as elements of cubes and beams

The difficulties students face on this item are as follows: (1) Three groups cannot answer at all the problem; (2) Students do not understand the concept of calculation so easy to forget and be fooled when solving the problem. Students are only capable of sketching sketches but not counting them.

3.6 Review Analysis

In the defining activity of defining cubes and beams in these three-dimensional spaces, there are several tasks. In this LKS, students do not have difficulty in doing all the tasks available. Based on the data obtained, the LKS or this task need not be revised, but teacher intervention is needed to help students determine the names of the dotted spots on the students' webs.

In determining activities identifying and solving problems related to the properties and elements of cubes and beams in this three-dimensional space there are several tasks. In this LKS, students do not have difficulty in doing all the tasks available. Based on the data obtained, the LKS or this task need not be revised, but teacher intervention is needed to help students determine the names of the dotted spots on the students' webs. Here's an example of student answers that indicate that students have no difficulty: Students not only sketch but also count them.

In determining activities identifying and solving problems related to the properties and elements of cubes and beams in this three-dimensional space there are several tasks. In this LKS, students do not have difficulty in doing all the tasks available. Based on the data obtained, the LKS or this task need not be revised, but teacher intervention is needed to help students determine the names of the dotted spots on the students' webs.

4. Conclusion

Based on the results of research and discussion in this study, got the conclusion that the tasks presented on teaching materials (LKS) with scientific approach both in defining cubes and beams, identify and solve problems related to the properties and elements of cubes and beams. Making cube and beam nets, solving problems related to cube and beam nets, solving problems related to the surface area of cubes and beams. Beginning with the difficulties students face. Then based on the results of interviews with teachers and analysis of student difficulties in each indicator above, researchers revise the teaching materials as needed. When it is no longer found students' difficulties then the teaching materials are considered valid and ready for use by teachers and students.

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