

Dissemination of Mathematics 3-D Textbook to Improve Students Mathematical Communication Ability

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Abstract-This research is the last stage of developing three-dimensional mathematics textbooks to improve students' mathematical communication abilities. The implementation of the distribution of three-dimensional textbook products was carried out in secondary schools in Central Java to measure product effectiveness, involving six junior high schools, namely two junior high schools in Semarang City, two junior high schools in Demak District, and two in Pati District. After the product is implemented, the developer needs to see the results of achieving the goals. A goal that has not been achieved needs to be explained the solution so that the same error does not occur after the product is disseminated. The last activity from the development stage was doing packaging, diffusion and adoption. This step was done so that the product can be used by others. Packaging learning models can be done by printing a guidebook for the application of learning models. After the book is printed, the book is disseminated so that it can be absorbed (diffused) or understood by others and used (adopted) in their classrooms. Disseminated of the six schools showed the following results: 1) The results of observations of learning during the 2 meetings showed an average of 4.23, this shows that during learning has been carried out well, that is between the range 4 - 5 shows the implementation of learning has gone well. 2) The results of the teacher's response during the two meetings showed an average of 3.26, this showed the teacher gave a good response, namely between the range 3 - 4, indicating the teacher's response to learning was good. 3) The results of students' responses during the 2 meetings showed an average of 3.42, this indicates that the teacher gave a good response, namely between the range 3 - 4, indicating that the response of students to learning was good.

Keyword-Three-Dimensional Mathematics Textbook, Mathematical Communication Ability, Dissemination

I. INTRODUCTION

Mathematics is one part of science that is important in the pursuit of science and technology. Consequently, mathematics lessons at school play a role in training students to think logically, critically, and practically, and to be positive

and creative [1]. The competence necessary for students to have the ability to manage, acquire, and utilize the information to survive in a condition that is always changing, uncertain and competitive. The learning achievements of Indonesian students are of concern, when reviewed based on the results of research from Trends in the International Mathematics and Science Study (TIMSS) in 2015 for Indonesian students to rank 45th out of 50 countries. The low ability of Indonesian students in mathematics is also reflected in the Program for International Student Assessment (PISA) report which published the results of mathematics learning achievement surveys for school students in 65 countries, and Indonesia scored 335. The low achievements can indicate a lack of ability in understanding concepts of science which are given. There are still many schools that find their students less able to take lessons given by teachers due to lack of ability to their concepts understanding.

According to National Council of Teachers of Mathematics [2], there are five aspects in understanding mathematical concepts, namely: *problem solving, reasoning and proof, communications, connections, and representation*. This mathematical communication ability is often be ruled out by the teacher in learning mathematics in the classroom. One effort that can be done by the teacher to reduce learning saturation in students is by developing teaching materials in various forms of teaching materials. Teaching materials have a lot of variety or format. One form of teaching material that is most easily made by the teacher is teaching material in printed form such as books [3]. This research is a development research. Development is a research that emphasizes the ability of researchers to make a product more perfect. The product is in the ready-to-use category or used by the public [3]. A product is called effective if it provides results in accordance with the objectives set by the developer [4]. The product is said to be effective if the results of the product are in accordance with the objectives to be achieved and have gone through the stages for product improvement. The expansion of product trials has been carried out in six junior high schools in Semarang City, Demak District and Pati District..

II. MATHEMATICAL COMMUNICATION ABILITY

A. Definition of Mathematical Communication Ability

Communication in general can be interpreted as a way to deliver messages from the messenger to the recipient of the message either verbally or indirectly through the media. In communicating, you must think about how to make the message someone conveyed can be understood by others. To develop communication ability, people can communicate in various languages including mathematical language. While mathematical communication ability can be interpreted as a student's ability to convey something he knows through dialogue or mutual relations events that occur in the classroom environment, where there is a message transfer. The message that is transferred contains about the mathematics material that students learn, for example in the form of concepts, formulas, or strategies for solving a problem [5]. The parties involved in communication events in the classroom are teachers and students. The way to transfer messages can be oral or written.

B. Indicator of Mathematical Communication Ability

The following is an indicator of students' ability in mathematical communication on mathematics learning according to NCTM [2] can be seen from:

- (1) The ability to express mathematical ideas through oral, written, and demonstrate and visualize them;
- (2) Ability to understand, interpret, and evaluate Mathematical ideas both orally and in other visual forms;
- (3) Ability to use terms, Mathematical notations and their structures to present ideas, describe situations and situation models.

According to Sumarno [6] indicators that show mathematical communication ability are:

1. Connecting real objects, images, and diagrams into mathematical ideas;
2. Explain ideas, situations and mathematical relations, orally or in writing with real objects, images, graphics and algebra;
3. State activity daily in a mathematical language or symbol;
4. Listen, discuss, and write about mathematics;
5. Read with understanding a written mathematical presentation

Indicators of mathematical communication skills used in this study are as follows:

- (1). The ability to write questions about stories or events in everyday life into mathematical models (using symbols and mathematical notation)
- (2). Ability to explain mathematical ideas orally and in writing
- (3). Ability to pour mathematical ideas into image (visual).

III. THREE DIMENSION BOOK

According to Cobb [7] The book as a teaching material is a book that contains a knowledge of the results of an analysis of the curriculum in written form. Some things that become a reference in organizing student books and making the book different from other book characteristics according to Heather [8] namely a short and clear title.

Three dimension book is a learning media that looks can be observed from any point of view and has dimensions of length, width and thickness/height. Three-dimensional media can also be interpreted as a media group without projections which are three-dimensional visual presentation. This media group can be either original or dead, can also form as an imitation that represents the original. Original objects when used as learning media can be brought directly into the classroom, or students in one class are told directly to the real world where the original object is.

The following in Figure 1 is a three-dimensional Mathematics book that has been developed:



Fig. 1 Three Dimension Book

IV. RESULT AND DISCUSSION

Result

In this study the dissemination was carried out by conducting a wider trial of learning tools for junior high school population coverage in Central Java with a sample of six high school juniors in Semarang City, Pati District, and Demak Regency, namely; SMPN 1 Karangawen, MTsN 1 Karangawen kab. Demak, SMPN 4 Pati, SMPN 1 Juwana, SMPN 15 Semarang, and SMP PGRI 1 Semarang.

C. Research at SMPN 1 Karangawen

The results of the observations at SMP Negeri 1 Karangawen were obtained: 1) The results of observations of the implementation of learning during the two meetings showed an average of 4.40, indicating that during the learning process had been carried out well, that is, between the range of 4 - 5, it was shown that the implementation of learning had run well. 2) The results of the teacher's response during the two meetings showed an average of 3.20, this showed the teacher gave a good response between the range 3 - 4 indicating the teacher's response to learning was good. 3) The results of the students' responses during the two meetings showed an average of 3.60, this showed the teacher gave a good response between

the range 3 - 4 indicating the response of students to learning was good.

D. Research at MTSN 1 Karangawen

The results of the observations at MTS Negeri 1 Karangawen were obtained: 1) The results of observations of the implementation of learning during the two meetings showed an average of 4.40, indicating that during the learning process had been carried out well, that is, between the range of 4 - 5, it was shown that the implementation of learning had run well. 2) The results of the teacher's response during the two meetings showed an average of 3.20, this showed the teacher gave a good response between the range 3 - 4 indicating the teacher's response to learning was good. 3) The results of the students' responses during the two meetings showed an average of 3.50, this showed the teacher gave a good response between the range 3 - 4 indicating the response of students to learning was good.

E. Research at SMPN 4 Pati

The results of the observations at SMP Negeri 4 Pati were obtained: 1) The results of observations of the implementation of learning during the two meetings showed an average of 4.20, indicating that during the learning process had been carried out well, that is, between the range of 4 - 5, it was shown that the implementation of learning had run well. 2) The results of the teacher's response during the two meetings showed an average of 3.40, this showed the teacher gave a good response between the range 3 - 4 indicating the teacher's response to learning was good. 3) The results of the students' responses during the two meetings showed an average of 3.02, this showed the teacher gave a good response between the range 3 - 4 indicating the response of students to learning was good.

F. Research at SMPN 1 Juwana

The results of the observations at SMP Negeri 1 Juwana were obtained: 1) The results of observations of the implementation of learning during the two meetings showed an average of 4.00, indicating that during the learning process had been carried out well, that is, between the range of 4 - 5, it was shown that the implementation of learning had run well. 2) The results of the teacher's response during the two meetings showed an average of 3.20, this showed the teacher gave a good response between the range 3 - 4 indicating the teacher's response to learning was good. 3) The results of the students' responses during the two meetings showed an average of 3.60, this showed the teacher gave a good response between the range 3 - 4 indicating the response of students to learning was good.

G. Research at SMPN 15 Semarang

The results of the observations at SMP Negeri 1 Semarang were obtained: 1) The results of observations of the implementation of learning during the two meetings showed an average of 4.20, indicating that during the learning process had been carried out well, that is, between the range of 4 - 5, it was shown that the implementation of learning had run well. 2) The results of the teacher's response during the two

meetings showed an average of 3.20, this showed the teacher gave a good response between the range 3 - 4 indicating the teacher's response to learning was good. 3) The results of the students' responses during the two meetings showed an average of 3.40, this showed the teacher gave a good response between the range 3 - 4 indicating the response of students to learning was good.

H. Research at SMP PGRI 1 Semarang

The results of the observations at SMP Negeri 4 Pati were obtained: 1) The results of observations of the implementation of learning during the two meetings showed an average of 4.20, indicating that during the learning process had been carried out well, that is, between the range of 4 - 5, it was shown that the implementation of learning had run well. 2) The results of the teacher's response during the two meetings showed an average of 3.40, this showed the teacher gave a good response between the range 3 - 4 indicating the teacher's response to learning was good. 3) The results of the students' responses during the two meetings showed an average of 3.40, this showed the teacher gave a good response between the range 3 - 4 indicating the response of students to learning was good.

Discussion

The implementation of learning based on findings in six junior high schools in Semarang, Demak, and Pati, it turns out that mathematics learning devices can be implemented well, heterogeneous students in groups allow students to interact and discuss well, they can carry out tasks well, inter-competition member in the group. Positive responses that students have after learning with mathematics learning tools are supported by several factors, among others: Learning atmosphere that is not tight and students feel able to discuss and create, the three-dimensional book that is used has attracted students' attention, because it is accompanied by an attractive appearance, building space can be touched and touched directly by students, and students feel they have a new learning experience and are quite different from previous learning experiences. The teacher's response was also very good in mathematics lessons using three-dimensional mathematics books. Some things that can be seen as supporting factors are obtained by the positive responses of the mathematics teachers, namely; the teacher's desire to use the book for subsequent learning.

V. CONCLUSION

The conclusions of this study are: (1) Implementation of learning based on findings in the six Junior High Schools in Demak District, Pati District, and Semarang City, can be carried out well. This is indicated by the average value of the implementation of learning shows the range of 4-5 this shows learning goes well. (2) Teachers have a good response to mathematics learning that uses three-dimensional mathematics books to improve students' mathematical communication skills. This is indicated by the average response of teachers in the range 3-4 which indicates a good response. (3) Students have a good response to mathematics learning that uses three-dimensional mathematics textbooks to improve students'

mathematical communication abilities. This is also shown by the average response of students in the 3-4 range, this shows a good response. This is analogous with the results of the study of [8] which examined the use of mathematics learning videos in junior high school and [4] on the effectiveness of three-dimensional Mathematics Textbooks to improve students' mathematical communication abilities.

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