

Making a Math Teaching Aids of Junior High School Based on Scientific Approach Through an Integrated and Sustainable Training

E Pujiastuti¹ and Mashuri

Maths and Natural Sciences Faculty of Universitas Negeri Semarang
Gd. D-12 Kampus Unnes Sekaran Gunungpati, Semarang, Central Java - Indonesia

¹Corresponding author: emi.mat@mail.unnes.ac.id

Abstract. Not all of teachers of Mathematics in Junior High School (JHS) can design and create teaching aids. Moreover, if teaching aids should be designed so that it can be used in learning through scientific approaches. The problem: How to conduct an integrated and sustainable training that the math teacher of JHS, especially in Semarang can design and create teaching aids that can be presented to the scientific approach? The purpose of this study to find a way of integrated and continuous training so that the math teacher of JHS can design and create teaching aids that can be presented to the scientific approach. This article was based on research with a qualitative approach. Through trials activities of resulting of training model, Focus Group Discussions (FGD), interviews, and triangulation of the results of the research were: (1) Produced a training model of integrated and sustainable that the mathematics teacher of JHS can design and create teaching aids that can be presented to the scientific approach. (2) In training, there was the provision of material and workshop (3) There was a mentoring in the classroom. (4) Sustainability of the consultation. Our advice: (1) the trainer should be clever, (2) the training can be held at the holidays, while the assistance during the holiday season was over.

Keywords: training, scientific approach, teaching aids.

1. Introduction

1.1. Background

The teacher teaches mathematics at JHS still need teaching aids. However, not all of mathematics teachers in JHS can design and make teaching aids that are needed. Moreover, the teaching aids should be designed so that it can be used in learning through scientific approaches.

Therefore, we need training for the mathematics teachers of JHS on how to design and to create teaching aids that can be presented through a scientific approach. The training is said to be very effective if the teacher can absorb and apply to training materials and after completion of the training. Thus, we need a model of training for teachers that effective, scalable, programmable, integrated, and sustainable after the training is completed. On the other hand, the current curriculum that applies is the Curriculum of 2013 Revised Edition. In this curriculum, learning is carried out through a scientific approach. Therefore, the teaching aids that is used by the math teacher is also highly recommended to be implemented through a scientific approach as well.

1.2. Problems of this Study

The problem as an element of novelty that resolved through this study was as follows. How to implement an integrated and sustainable training so that math teacher of JHS, especially in Semarang can design and create teaching aids that can be presented to the scientific approach?



1.3. Objectives of this Study

The purpose of this study to find a way or model of integrated and sustainable training so that the math teacher of JHS can design and create teaching aids that can be presented to the scientific approach. As an element of novelty that resolved through this study was as follows. How to implement an integrated and sustainable training so that math teacher of JHS, especially in Semarang can design and create teaching aids that can be presented to the scientific approach?

1.4. Benefits

The expected benefits to the findings of the training model were as follows. (1) For the math teachers of JHS, were expected to become more skilled and innovative in design, build, and utilize the manipulative mathematics presented with a scientific approach; (2) A greater insight will be owned by the training providers on a way the implementation of the training, the training associated with learning that utilizes the manipulative for the math teacher of JHS based on scientific approach which is innovative, integrated, applicable, and sustainable.

2. Literature Review

2.1. Definition and Utilisation of Teaching Aids

A teaching aids in mathematics learning is a form of the learning media. Learning media can be as textbooks, blackboards, teachers themselves, pictures, graphics, shapes geometry models, and so on. According to Suharjana (2009), instructional media were all objects that could be a mediator in the learning process. Based on the function of media can take the form the teaching aids and equipment. Therefore, the teaching aids in mathematics learning was a part of the learning media [11].

Government Regulation No. 19 of 2005 on Article 42 (1) stated that "Each educational unit has to have the means, which includes furniture, appliances education, media education, books and other sources, materials consumables, and other equipment needed to support the process regular and continuous learning ". It means the teaching aids are part of the means that must be owned by any educational institution.

The position of the teaching aids associated with the method component of teaching is one of the efforts to enhance the process of interaction between teachers and students in the learning environment. Objects in the mathematics learning of facts, concepts, principles, and skills is an object of the mind which are abstract and can not be observed by the senses. Therefore it is natural that some students do not easily understand mathematics.

Widyantini and Sigit (2009) wrote that to overcome the math easily understood by the students, then in studying an object in mathematics needs experiences through real objects (concrete objects) namely teaching aid that can be used as a bridge for students to think abstractly. Students will better understand abstract mathematical concepts that are presented in the form of concrete. The learning activities that use the teaching aids is a great significance for the success of student learning.

It is expected that by using a teaching aids students can see, feel, express by thinking directly to the object which is studied. Thus, the abstract concept that is being studied is absorbed in the minds of students. The use of teaching aids can be associated with the aspects of concepts planting, understanding of the concept, proof of a formula, as well as coaching skills. Also, the use of teaching aids also can increase student motivation.

In the book of Curriculum 2013 explicitly suggested that teachers use the media or alternative learning resources available in the school environment. Such facilities can be a person, material or events. Thus, the ability of a math teacher in the junior high school to be able to make the teaching aids and use in learning is very necessary.

2.2. Requirements of A Good Teaching Aids

Teaching aids can be used properly if they meet several requirements. These requirements are as follows. (1) the teaching aids are made by a concept or a mathematical formula that is being provided. (2) easy to present, so the abstract concepts become easily absorbed by students through the use of the teaching aids. (3) Students have become more active in learning and independent by using the teaching aids.

The teaching aids which made should also meet the following requirements. (1) Made from a good material to belong durability. (2) Do not harm the wearer, for example; there is a sharp wire bonding or no spikes that can hurt a finger, and so on. (3) Made with a variety of shapes or interesting colours. (4) The size is fit so easily seen by the students who sit in the back. (5) can clarify the concepts of mathematics and not vice versa. (6) Easy to carry, used, and stored back.

2.3. Scientific Approach in Utilising the Teaching Aids

The current curriculum in Indonesia is Curriculum of 2013 Revised Edition. In Curriculum of 2013 Revised Edition, the learning is carried out through a scientific approach. Stages in the scientific approach, the learning is implemented through a series of learning activities of students to: (1) observe, (2) ask, (3) collect information, (4) associate, and (5) communicate. Because the math teachers of JHS need to use the teaching aids in their teaching, the presentation of these teaching aids is also conducted by a teacher with the scientific approach as well. Utilisation of the teaching aids in mathematics learning is done through a scientific approach, required the creativity of teachers so that the creativity of students is also growing and be able to absorb the material optimally.

In connection with the description above, if the junior high school math teacher will foster students' creativity in mathematics learning, it is necessary to look for the learning that can (1) make the students active in learning, (2) students brave to find or express ideas, (3) encourage students to develop their creativity, (4) math subject made the atmosphere become fun, and (5) can train students to help each other positively and politely.

Teachers can also obtain such learning during the previous lecture or through training. Figure 1 below is one of the training model followed by the teachers.



Figure 1. Teachers activities in training

2.4. Effective Training

Teachers need to follow a structured training in an integrated, scheduled, and sustainable. Jacob and Lefgren (2004), Siegle and McCoach (2007), also Cabrita et al. (2015) wrote that mathematics teachers followed the effective training can enhance students' ability in mathematics. Increased knowledge of the teachers, especially those related to the material of mathematics, mathematics learning, or training on the use of the teaching aids is needed. Thus, how to implement an effective training, integrated, sustainable, and meaningful need to be found. Figure 2 below, an illustration or description of the math teachers of Junior High School attended training on how to design and create off the teaching aids [1,3,10].



Figure 2. Teachers activities make a teaching aids in a training

3. Research Methods

3.1. Approach and data analysis

This article is based on research with a qualitative approach. Analysis of the data, according to Miles and Huberman (1994 and 2014), and Moleong (2010), that the activity in qualitative data analysis performed interactively and lasts through to the end. Activities in the analysis of the data include data reduction, display data, interpretation of data, and conclusion drawing /verification [5,6].

3.2. Time and location

There are two stages in the research time. The first stage has been implemented in the Academic Year 2014/2015. Stage 2 has been completed in the Academic Year 2015/2016. Location of research: At the centre of MGMP activities of math teachers in Semarang and the centre of MGMP activities of math teachers of Salatiga district.

3.3. Activities

Based on the problems and objectives to be achieved, the activities of study as supporting this article includes the beginning assessment on the needs of the math teachers of JHS in Semarang in the teaching-learning process, the research team make a designing training activities, conduct of training on the teacher Training, Assessments test, analyzing the results of assessment, implement Focus Group Discussion (FGD), testing in the teacher testing, the selection of the research subjects, interviews, triangulation, and FGD order to obtain a training model or training method that allows the math teachers of JHS can design and create that teaching aids can be presented to the scientific approach.

FGD implementation involves the team of researchers, two lecturers/students who were interested, and three the math teacher of JHS who concerned, to found an integrated training model, programmed, sustainable, and applicable.

4. Results and Discussion

4.1. Result of this Study

Based on the results of the activities, the results of assessment tests, FGD, experiment, interview, and triangulation it has obtained the study results that conclusive were as follows. (1) The math teacher of JHS who became a trainee begin to understand the meaning of scientific approach and its application in learning. (2) The math teacher of JHS who became a trainee begin to understand the use the teaching aids mathematics used to teach with a scientific approach. Some teachers have been able to demonstrate the use of math learning a teaching aids used to teach with a scientific approach. Teaching aids prepared and taken by the trainer as a model. (3) The math teacher of JHS who became a trainee has been able to create a lesson plan that includes the use of teaching aids of mathematics learning used to teach with a scientific approach. (4) Through the FGD, it has arranged a training model on how to make and to use teaching aids of mathematics learning that is used to teach with a scientific approach. This Training model then tested or implemented. These training activities include the provision of material, particularly on the application of scientific approach, design and making of lesson plans, learning models, workshops, learning simulation, and mentoring in the classroom through activities such as lesson study, namely the teachers teaching and lecturers trainer followed some teacher trainees participate viewed the learning activities in the classroom. After mentoring in the classroom, it was followed by reflection and evaluation. Training schedules to be created programmatically, integrated and scheduled well. (5) Consultations between the lecturer's trainer with math teacher trainees of JHS to do after the training period was completed (ongoing).

Also, through the FGD, successfully strengthened the trial results of training model in the creation and utilisation of scientific approach based on teaching aids for the math teacher of JHS. Thus, the

problem of this study has been solved. The objective of study has also been achieved which has found a way or a training model that the math teacher of JHS can design and create teaching aids that can be presented to the scientific approach. According to Popa & Bucur (2014), teachers who want to improve themselves by the following training, for example of mathematics learning, will be able to improve it is competitive [9].

4.2. Discussions

According to Carbonneau, K.J. et al. (2013) and Moyer (2001), using teaching aids was very effective in learning mathematics. Thus the provision of training in the math teacher of JHS on how making and using teaching aids for mathematics learning that used to teach based on the scientific approach was very important [2,7].

Through training that programmed and scheduled properly, then the effectiveness of the training will be high. Training activities were carried out through the provision of material, especially on the approach scientific, preparation of lesson plans appropriate, the learning model who involving the trainer and teachers elected, forwarded the workshop of manufacture of a teaching aids, then the learning simulation, and mentoring in the classroom through activities such as lesson study, then this training model becomes effective and useful.

Also, the implementation of the FGD that is followed by the team of researchers, two lecturers/students who were interested, and three of the math teacher of JHS related, also the implementation of reflection and evaluation, making the training model that is resulting was becoming more applicable and useful.

5. Conclusions and Suggestions

5.1. Conclusions

Based on the result of this research and the discussion above, then the conclusions which were obtained that the research team has succeeded in constructing a model of training activities for the math teacher of JHS in Semarang about way of making and using a teaching aids of mathematics learning that is used to teach with a scientific approach.

Training models include the provision of training materials, teaching models by utilising teaching aids, practice makes a lesson plans that appropriate, forwarded with a workshop of manufacture of teaching aids, then the learning simulation, mentoring in the classroom, and reflection. Through the implementation of a training model that was programmed and scheduled then the results were as follows. (1) The teacher trainees have understood the meaning of scientific approach and its application in learning. (2) The teachers have understood the use of teaching aids of mathematics learning that used to teach mathematics with scientific approach. (3) Through the workshop, the teachers through work in the group have been successfully in designing and creating teaching aids of the mathematics learning of JHS that can be presented through a scientific approach.

5.2. Suggestions

Suggestions that can be recommended are as follows. (1) When the training model was followed up by an institution, then the ability of trainers should be accountable. (2) The training can be held at the time of the holiday season, while mentoring can be carried out when the holiday period finishes. (3) In order, a teaching aid produced becomes good, the making of teaching aids given sufficient of breaks time. (4) Consultations between the trainer lecturers and teacher as trainees to do after the training period are completed (ongoing/ sustainable).

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