

**DEVELOPMENT OF TRAINING MODEL
FOR MAKING OF TEACHING AIDS BASED ON SCIENTIFIC APPROACH
AND ITS APPLICATION**

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ABSTRAK

***Abstract.** Junior High School (JHS) students who are less gifted in mathematics need to have a good understanding of mathematics is received. Teachers math should enhance creativity among others through the use of teaching aids in learning. The main problem will be solved in this study was: How to develop a training model in the manufacture and use of teaching aids through JHS mathematics teacher competence searches based on scientific approach. As a qualitative research, capturing data through intensive discussions in the Focus Group Discussion (FGD), the results of tests of training models, observation, questionnaires, and interviews intensive open, followed by the triangulation to obtain an innovative training model and applicable. The results of the research were: (1) the results obtained a Training Model; (2) after tested, resulting a training model in the manufacture and use of teaching aids through JHS mathematics teacher competence searches based on scientific approach; (3) has published the results of this study at the International Seminar and published in the International Journal.*

Keywords: *mathematics, teaching-aids, scientific approach.*

Introduction

Not all students, especially at the basic education level has a good talent in mathematics. However, the math must be given at all levels of education. In order for students who are less in mathematics have a good understanding of mathematics that they have learned, then the math teachers should enhance student's creativity to increase absorbency and also grow the their creativity. One way that the teacher's creative ability, especially in primary education can be fostered is through assisted mathematics learning for example teaching aids are packed with Hand-on Activity.

However, not all teachers are able to think and find ways to exploit the use of teaching aids to be operated through the activities that must be done by the students themselves, until the concept or the material being taught teachers can be received and absorbed by the students. Therefore, if the teacher is able to think and find ways to exploit the use of teaching aids to be operated through the activities that must be done by the students themselves, until the concept or the material being

taught teachers can be received and absorbed by the students then the creativity of teachers and students will be grow and develop. Hopefully, teaching aids not only brought and demonstrated by the teachers, the students only nodded, took notes, and teachers assume that students already know. The risk may indeed exist, such as the added cost, length of time, the need for additional equipment, or yet the emergence of the idea of the teacher. However, there is a will; there is a way. Where there is a will, there is a way.

Teachers math should enhance their creativity through the use of teaching aids in learning. Competitive Research Grant 2nd year, it has been preceded by research of year 1 the results: (1) The math teacher in junior high school has been able to interpret the scientific approach to learning. (2) The teachers assume that the teaching aids to be needed in the concept of learning to be quickly absorbed by the students. (3) Teachers feel less good at making the teaching aids, particularly female teachers. The teachers feel less confident in designing and utilizing teaching aids. (4) The school teachers need training to enable teachers skilled in using teaching aids. (5) The resulting draft training model for teachers in accordance with the needs of teachers in the field.

Issues

From the above description of the background and as a follow up of the results of research competitive grants year 1, the main problems to be solved in the 2nd year of research are as follows. How to develop a model of training in making and using teaching aids through Junior High School mathematics teacher competence searches based scientific approach?

Of the main problems mentioned above can be broken down into the following sub-problems. (1) How do the results of a review of the draft Model Training in the creation and utilization of scientific approach based learning tools for junior high school math teacher? (2) How do get through intensive discussions in FGD (Focus Group Discussion), getting the review of draft training model that is more stable? (3) How do the results of the analysis after conducting trials Training Model in the creation and utilization of scientific approach based teaching aids for JHS math teacher? (4) How do the results of reviewing the training model is based on the FGD results?

Targeted Innovation

Innovation targeted for this research activities were: (1) Junior High School math teachers skilled and innovative in design, manufacture, supply, and utilizing teaching aids of mathematics; (2) the emergence of a training model of learning by utilizing teaching aids for JHS mathematics teachers based on innovative scientific approach and applicable; (3) the emergence of models of assistance in learning by utilizing teaching aids for JHS math teacher based scientific approach.

Teaching Aids Utilization in Learning

The students at the basic education level, namely SD/MI or SMP/MTs (Junior High School) in general is still at the stage of concrete thought. If there are students in primary education has been able to become a champion in the math contest national or even international level, it is only a small portion, or very little of all students at the basic education level. "Special" children which has a very special intelligence are not discussed in this description. Studied the children of regular, normal kids, or kids with ordinary intelligence. Students like these, it seems necessary

teaching aids to accelerate the absorption rate in accepting the subject matter. In lessons, Suharjana (2009) wrote that the medium of learning is defined as all objects that become intermediaries in the learning. Based on the function of media can take the form of teaching aids and means

So, teaching aids in mathematics learning is part of the media learning. Government Regulation No. 19 of 2005 Section 42 (1) said that "Each educational unit shall have the means, which include furniture, appliances education, media education, books and other sources, materials consumables, and other equipment needed to support the learning process regular and sustainable ". Clear that the teaching aids, which is one form of media education is part of the means that must be owned by each unit of education, especially at the basic education level. Suyitno (2007) wrote that the media are different types of components in the environment that can be used student teachers to motivate students to learn. While the position of the teaching aids associated with the components of teaching methods and became one of the efforts to enhance the process of teacher interaction with students in their learning environment. The learning activities that use teaching aids of great significance for the success in student learning. It is expected to use learning tools students can see, feel, express the thought of direct object they are studying. Thus, the abstract concept being studied can precipitate, inherent and long-lasting in the minds of students' minds. The use of teaching aids can be associated with aspects of planting concepts, understanding of concepts and skills development, and also increase student motivation.

In a teacher book on Curriculum of 2013 written explicitly that the teacher suggested to teachers pay attention to the following: "Use media or alternative learning resources available in the school environment, such means can be a person, material, or events".

Functions and Roles of the Teaching Aids

In general, the function and role of teaching aids, among other things: (1) overcome the differences in student's personal experience; (2) to overcome the limitations of space, time, and the sense of power; (3) make abstract concepts concrete; (4) clarify the presentation of the message, so not too verbal; (5) complements and enriches the information in learning activities; (6) laid the foundations that are important for the development of learning, therefore, can make lessons more steady; (7) gives a real experience that can grow on their own activities among students; (8) replacing the dangerous objects or difficult to obtain in the learning environment; (9) allows students to interact directly with the environment; (10) allows uniformity observations and perceptions of students' learning experience; (11) generate interest/motivation to learn; (12) gives the impression of individual attention to all members of the group; (13) controls the direction and pace of student learning; (14) to increase effectiveness and efficiency in the delivery of the message (lessons); (15) add variety in the presentation or delivery of messages (lessons); (16) gave similarities/unity in the observation of something in the early observations of students may vary.



Figure 1. Various kinds of teaching aids of mathematics which can be provided by the teacher/school

In the selection of teaching aids, there are requirements that must be met by a teaching aids to be used in accordance with the needs of the learning. Teaching aids that will be used by a teacher should be a tool, enables students to understand a theory or find a proof formula, so that students can work. Some of these requirements, among others, as follows. (1) Should be made of strong materials so durable and long lasting. (2) Shape of teaching aids attractive and the color appealing to the eye. (3) Simple, easy to carry and easy to use. (4) The size is fit so easily viewable by students who sit in the back though. (5) To present mathematical concepts in the form of real, picture or diagram. (6) In accordance with the mathematical concepts that are being taught. (7) To clarify the concepts of mathematics and not vice versa. (8) The use of teaching aids is expected to be the basis for the growth of the concept of abstract thinking for students. (9) Make the students to learn actively and independently by manipulating teaching aids. (10) If possible, it may be expedient fold (more than one).

Criteria used teaching aids are very dependent on the following points. (1) Purpose. Selection criteria teaching aids that can affect the learning objectives will be achieved if the teaching aids are able to increase the domain, cognitive and psychomotor which is the purpose of a lesson. (2) The subject matter. Teaching aids are usually used to help students understand a basic concept in mathematics learning materials that help students master the material in scope and difficulty higher. Demonstration of basic concepts used to facilitate the concept further. (3) The learning strategy. By using teaching aids will facilitate teachers in implementing the strategy of teaching. The use of teaching aids is a learning strategy in the methods of the invention or the methods of demonstration. (4) Conditions. Teaching aids help teachers in certain conditions e.g only on condition of a classroom full of students so required loudspeakers to facilitate teachers to be heard by the students when describing the material. (5) Students. Selection of teaching aids tailored to what is preferred by students for example teaching aids that form of the game but it is certainly not without learning goals.

Utilization of the Teaching Aids through Scientific Approach

In education minister rules No. 103 of 2015, the scientific approach to learning includes the stages of observation, ask, gather information, associates, and communicate. One model of learning by utilizing teaching aids that can be presented to the scientific approach is the Hand-on Activity.

Hand-on activity (HoA), is a learning activity that engages students to engage in activities that involve almost all the five senses, physical activity, and supporting tools. The students involved in the brood, observe, ask, gather all the information, measure, reasoning, drawing, cutting, folding, or paste the results of his work, and finally students are expected to communicate the idea to his friends. In the hands-on learning activities of this activity, it is sometimes necessary facilities and a small fee for the supporters, for example, the need for the availability of hvs paper, manila paper, a ruler, scissors, glue, and the like. The photos below illustrate, the students who are being trained teachers to find their own nets cube through learning activities, hands-on activity. Teachers provide a single example of nets cube, students were required careful to observe, then inquire, then discussed in the group to gather all the information in the search for nets that are different from a cube, the students tried to associate/reasoning, to find, and if it finds it, the students are asked to communicate it to the class.



Figure 2. Through group work, students do activities of hand on activity by using objects that is around the school

Teacher's Creativity Power in Creating Innovative Teaching Aids

Math teacher creativity in creating/designing and making innovative teaching aids that would be required. Teaching aids are designed and made teachers, are expected to match the material presented.

Creativity or creative thinking ability, is the act of thinking that produces creative ideas or new ways of thinking (innovative), original, independent, and imaginative. Creativity of the teacher can be seen as a mental process. This creativity refers to the ability to think more step forward and is a product of an idea than most others.

In line with the above article, then according to Naiman (2006), creativity is the act of turning new and imaginative ideas into reality. Creativity involves two processes: thinking, then producing. Innovation is the production or implementation of an idea. If you have ideas, but do not act on them, you are imaginative but not creative. So Naiman illustrate that creativity as an act of imaginative play ideas and a new character into reality. Creativity involves two processes, namely thought and then produce. Innovation is the result or the implementation of an idea. If someone has ideas but not through processes that then someone was saying imaginative but not creative people. Hassan (1997) wrote that creativity which means efforts to create or inventiveness. Words creativity also comes from the Latin word creare which means "to make". According to Young (1999), creativity Greekkrainein also comes from the word meaning "to meet." However, according to

Torrance (1988) is very difficult or impossible to give a definition that is really appropriate. The reason, because the characteristics of the creative power it self also an infinitive and involve all the senses possessed by humans, including the senses of sight, hearing, smell, taste, and feeling. Torrance (1988) also added that it very difficult to express the definition of creativity in the form of words. Apart from that, Isaksen (1987) also confirmed that very difficult to give a precise definition of creativity energy that is concerned with the nature of creativity itself.

Isaksen (1987) also added another, that no one knowledge can claim that only knowledge are eligible to study creative power. Morgan & Forster (1999) explains that in the field of education, educators in their efforts to know for sure that creative students need to understand what is meant by creativity. According to Goh (1993), understanding of the concept of creativity is very important for teachers because through understanding, will be available one pattern guide for teachers in designing and implementing typical training program to enhance student's creativity.

According Croypley (2001), overall the experts in the field of creativity agree that creativity has three main elements, namely: (1) Authenticity (something the product, action or creative ideas should be aberrant). (2) Achievement (achieving the desired goal). (3) Ethical (creative terms are not usually used to describe the actions of selfish as arrogant, destructive behavior, and the like). In conclusion, understand the concept of creativity is in fact, very important especially for teachers who acts fosters the creativity of students in class. Teachers in primary education, especially school teachers need courage to make changes in the learning process by making breakthroughs or choose how learning cutting edge and new for teachers. Of course, the implementation of an innovative new way of learning that must be carried out with dedication and responsibility as educators, especially as a teacher in primary education in the teaching of mathematics.

In order to foster creativity math teachers in primary education, the teacher needs to: (1) always think, to follow up the results of his thinking, and implement the idea on how your learning material can be absorbed by the students well; (2) The math teacher trying to find new ways/innovative in order to utilize the teaching aids can be packaged/presented through Hand-on Activity; (3) the teacher should always strive to develop the idea that teaching aids are not only brought to the front of the class, was shown to the students, was demonstrated to students or ask one student to try, the students just sit tight, and finally the students only recorded if required or ordered teachers.

In addition to the above, so that the creativity of the students also can grow and develop, then the attitude of the teacher should: (1) willing to listen to opinions, questions, or even complain of students; (2) are willing to respect the opinion of the students, even if it is incorrect; (3) to foster and develop the self-confidence of students; (4) is ready and willing to provide a challenge to the students; (5) encourage students to dare to express ideas; (6) dared to create a sense of fear of being wrong on students. It is needed by the students, because if the students at the basic education level are wrong, then students will not dare to try new things, which means that students are not developing creativity.

Creativity is not developing both teachers and students, will result there will be no new invention (no effectiveness in learning). In connection with the foregoing, if the teachers at the basic education level will foster creativity of students in mathematics, it is necessary to look for the kind

of learning that is able (1) to enable student learning, (2) encourage students to dare to reveal ideas/his own invention, (3) encourage students to think in any other way or think of alternatives, (4) students take pleasure in learning mathematics, and 5) improving cooperation among students through polite ways of behaving.



Figure 3. For active students, the teacher's creativity designing and making teaching aids would be required

Relevant Studies

Some studies related to utilization teaching aids and this scientific approach them are as follows. Suharjana (2009) concluded that the learning media is defined as all objects that become intermediaries in the learning. In addition, research Pujiastuti and Suyitno (2014) also identifies and analyzes the Junior Mathematical teaching aids based on the implementation of Curriculum of 2013, which uses a scientific approach. Additionally, Rochmad, Suyitno, and Sugiharti (2012) in a study conducted in SMA 1 Temanggung concluded that the use of media in teaching mathematics Mouse Mischief can improve the ability of students in SMA 1 Temanggung in solving mathematical problems.

Furthermore, Pujiastuti and Mashuri (2015) in research competitive grants 1st Year has found the draft Model Training in the creation and utilization of scientific approach based learning tools for junior high school math teacher. This training model needs to be tested and analyzed the results of the testing can take in order to obtain an innovative training model and applicable.

Special Purposes Research

Special-purposes research grant competition 2nd year were as follows. (1) Getting results from reviewing the draft Model Training in the creation and utilization of scientific approach based teaching aids for junior high school math teacher. (2) Through the intensive discussions in FGD (Focus Group Discussion), to get the results of a review of draft training model more stable. (3) Conducting trial training model in the creation and utilization of scientific approach based teaching aids for junior high school math teacher and analyze the results qualitatively. (4) Reviewing the back (target) of the Model Training based on analysis of the results of tests in order to obtain an innovative training model and applicable.

Benefits of Research

The planned study is considered very helpful/urgency for the following reasons. (1) It is known in the junior high math teacher's ability to interpret the scientific approach to learning. (2) It is known in the junior high math teacher's ability to interpret the use of teaching aids in the learning of mathematics. (3) Empower junior high math teacher competence in the design, manufacture, supply, and utilizing teaching aids for mathematical learning. (4) To produce a training model to use teaching aids for Junior High School math teacher tiered, integrated, and in accordance with the needs of teachers in serving the learning of their students, based on a scientific approach. Innovative training model and applicable.

Research Methods

The subjects are math teachers in the Semarang regency incorporated in MGMP activities. Furthermore, it would taken MGMP math teachers in the city of Semarang and MGMP math teachers in Salatiga regency.

Time and Location Research

When the study was designed there are two stages, according to the research targets. For the year-1 is already implemented in the Academic Year 2014/2015. As for Phase (Year) 2nd will be held in the Academic Year 2015/2016. Location of research: At the center of activities MGMPs math teachers in the city of Semarang and in the MGMP math teachers at Salatiga regency.

Target Achievement Research

To achieve the objectives of this study the research method is done in 2 stages. Phase I (target achievement of the objectives for the year to-1) has been completed to the reporting. Phase II (target achievement of the objectives for the 2nd year) in the form of four main activities, namely: (1) Getting results from reviewing the Training Model draft in the creation and utilization of scientific approach based learning tools for Junior High School math teacher. (2) Through the intensive discussions in FGD (Focus Group Discussion), to get the results of a review of draft training model more stable. Activities in FGD followed by (a) the team of researchers, (b) 2 students who are interested, and (c) 3 JHS math teacher concerned. (3) Conducting trial training model in the creation and utilization of scientific approach based teaching aids for junior high school math teacher and analyze the results qualitatively. (4) Reviewing the back (special target) of the Model Training based on analysis of the results of tests in order to obtain an innovative training model and applicable.

Achievement Indicators

Competitive Research Grant Achievement Indicators 2nd year are as follows. (1) Getting results from reviewing the draft Model Training in the creation and utilization of scientific approach based teaching aids for junior high school math teacher. Training Model generated draft in the study year 1. (2) Through the intensive discussions in FGD, resulting draft training model that is more stable. (3) The results obtained indicate a qualitative analysis of the trial Training Model in the

creation and utilization of scientific approach based teaching aids for junior high school math teacher. (4) The results reviewing (target) of the Model Training based on analysis of the results of tests in order to obtain an innovative training model and applicable.

Research Activities Performed

The research activities that have been done were as follows. (1) Has been carrying out a review the contents of the draft Model Training in the creation and utilization of scientific approach based teaching aids for junior high school math teacher. Draft Training Model generated in the study year 1. (2) Through the Focus Group Discussion, successfully strengthened on a review of the Training Model draft the creation and utilization of scientific approach based teaching aids for junior high school math teacher. (3) Found a prototype of the draft Model Training in the creation and utilization of scientific approach based learning tools for junior high school math teacher, to be tested. (4) To test the draft Model Training in the creation and utilization of scientific approach based learning tools for junior high school math teacher.

Research Result

The results of this study were as follows. (1) Managed to review the content of the Training Model draft in the creation and utilization of scientific approach based teaching aids for junior high school math teacher. Training Model draft generated in the study year 1. (2) Through the Focus Group Discussion, successfully strengthened on a review of the Training Model draft in the creation and utilization of scientific approach based teaching aids for junior high school math teacher. (3) Found a prototype of the Training Model draft in the creation and utilization of scientific approach based teaching aids for junior high school math teacher. Draft Training Model generated in the study year 1, and have been tested.

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