

Realistic Mathematics Learning Using Cooperative Strategy Model in Junior High School

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Abstract: This study aims to develop a realistic mathematics learning model using cooperative strategy. This study applies research and development approach conducted at Junior High School *Laboratorium*, State University of Malang. The implementation of this model is conducted through five stages: 1) previous study phase; 2) model planning phase; 3) model implementation phase; 4) practicality assessment phase, and 5) model effectiveness phase. The result of this study shows that the model that has been developed can be used by teachers through focusing the attention to express students' ideas; besides, it is also used as a model to improve the quality of mathematics learning through the improvement of teacher professionalism.

Keywords: mathematics learning, mathematics realistic, professionalism

1. Introduction

The development of Indonesian national education has not showed a significant expected result (Depdiknas, 2005). There are many factors determining the success of achieving educational goals, namely: facility accessibility, qualified human resources, learning implementation and its assessment, supervision, sufficient funding, educational bureaucracy, local education authority, and Ministry of National Education. All those components are correlated each others to determine the success of education; for example, the poor quality teacher will influence the learning process, on the other hands, the success of learning depends on the learning model implemented by the teacher.

Generally, the development of national education faces some problems related to the low quality of process and outcome of education. Those problems of education quality do not independently exist by themselves, but they are linked each others in an influenced mutual system. The quality of educational outcome is influenced by the quality of input and process. Externally, the educational input components that significantly affect the quality of education consist of: 1) inadequate qualified human resources; 2) lack of learning facilities and their less optimal usage; 3) insufficient educational funding to support the learning quality; and 4) less impressive and efficient learning process (Depdiknas, 2005).

The impact of insufficiency on the input and process component in the educational system causes low quality of education in Indonesia, especially in learning mathematics. It can be seen from the result of NEM (Score of Final Learning Evaluation) on mathematics course in Junior High School which shows low score. It shows that the score range of mathematics original national exam score for Junior High School from 1997 to 2001 is between 5:13 and 5:48. This score is not too different from those in East Java (Balitbang Depdiknas, 2002). Likewise, the National Examination score which replaces Final Learning Evaluation shows that the average score for mathematics course in 2003/2004 is 5.55 and 6.76 for 2004/2005. The evidence of the low quality of mathematics education is also showed by the result of the study done by Programme for International Student Assessment (PISA), which puts Indonesia at the 39th position of mathematics education from 41 countries are assessed. As a comparison, Korea is on the 3rd position (Depdiknas, 2005).

In addition, the Centre for Educational Assessment of National Education Ministry reports the result of Junior High School national examination for mathematics course, for both private and public school. The national mathematics examination score for East Java province in academic year 2008/2009 shows the score increasement comparing to the previous year; its mean is 7.11 with the lowest score is 0.50 and the highest score is 10. In addition, Malang shows that the mean of mathematics national examination score is 6.92, with the lowest score is 1.25. From that Malang mean of national examination score, it can be seen that there are for about 45.39% of the students who get score less than 7, which is the range is between 3 – 5. This is an evidence that shows the low of Junior High School national examination score in Malang; moreover, the requirement to pass the national examination is by getting score at least 5.50.

Related to the process quality, some of the important factors influencing the process are the teaching model and teaching strategy. A good learning result cannot be separated from the teaching model and teaching strategy used by the teacher. Although the recent national curriculum has been changed from curriculum 1994 to curriculum 2004, there are still some problems on its implementation. There are some teachers don't entirely understand how to implement the curriculum 2004 which has constructivism orientation. Most of teachers still use traditional

teaching method which characterized by centered teacher model. It is indicated that the change of curriculum from curriculum 1994 to curriculum 2004 is because the curriculum 1994 is full of cognitive content. Therefore, to implement KBK (Competency Based Curriculum) well in classroom, it needs to be supported by new teaching strategy which is applicable for mathematics learning that oriented at constructivism theory. One of the strategies common used for mathematics teaching and learning is cooperative learning

Cooperative learning is a learning model which prioritizes on group work appreciation. The concept of this strategy or model is done through sharing problem and idea among the learners. It is from an educational tradition emphasizing on thinking, practicing and applying democratic, active learning, cooperative behaviour, and respecting difference in multicultural society. Through this cooperative strategy, it is expected that the curriculum 2004 is able to be implemented well.

2. Research Method

This study applies research and development approach. It is an approach which creates a mathematics learning namely PMRBK. This study aims to create mathematics learning, PMRBK, which is valid, practical, and impressed. To support the implementation of this method, there are some learning instruments and devices should be prepared.

This chapter will explain about the research method is going to be done. Starting from the research definition, procedure, ethics, model, model development, instrument, validity, practicality, effectivity, and planning to evaluate the learning.

The subjects of this study are teacher and students of VIII grader who involve in mathematics learning using PMRBK model in "Laboratorium" Junior High School State University of Malang. To take these subject are based on: 1) for a long time, "Laboratorium" Junior High School is categorized as school which gets enough category in term of mathematics achievement, so it is expected that by implementing PMRBK method in mathematics learning, the students achievement will be better than before; 2) "Laboratorium" Junior High School is a private school in Malang which is categorized as a school which has medium predicate, so the result of this study conducted in this school can be a model for other school throughout Malang both private and public school; 3) There is no study before done in this school which implementing the PMRBK method, so that the result of this study will show the real condition of the school achievement; 4) the teachers in "Laboratorium" Junior High School are still young teachers, so it will be helpful to develop the teaching method; besides, by having the young teachers, it is believed that it will increase the students achievement comparing to the old teachers; 5) the score which is accepted for enrolling study at "Laboratorium" Junior High School is relative low comparing to the public school, so the writer is interested in conducting a study in this school by expecting the students learning achievement will increase; in addition, the writer expects that he can contribute a teaching method for the learning activity in this school; 6) "Laboratorium" Junior High School is a private developing school in which a teaching method is one of the teaching and learning concerns that needs to be developed.

3. Finding and Discussion

3.1 Teaching Theories

In this chapter, it will be discussed about the teaching theories related to the teaching method is going to be implemented in this study. Besides, it will be discussed about some theories related to teaching method development which is implemented, such as cooperative learning, constructivism learning, and RME.

There are four aspects that need to be considered in teaching implementation, namely strategy, approach, method, and teaching model. These four aspects have an important role to help the students to understand and comprehend the learning subject matter; besides, these are also the components of a model in teaching implementation. Learning strategy is stages used to achieve the teaching and learning goal which cause a learning effectiveness. Approach is a way done by the teacher in his or her teaching implementation to help the students to comprehend and understand the subject matter explained by the teacher. Further, method is a way to explain a general subject matter. In teaching and learning, method is not only to help teachers to explain the subject matter, since teachers' duties are not only transferring knowledge to the students but also guiding them to have an appropriate knowledge for achieving their learning goal optimally. While teaching and learning model is interaction between teacher and student in the classroom involving strategy, approach, and teaching method.

The next discussion is about the theories related to this study. Theory is a collection of concepts which are correlated each other that build a framework of thinking to explain certain phenomena. While teaching and learning process is a process to obtain knowledge. So, it can be concluded that teaching and learning theory is an idea used to explain a process related to human's effort to obtain, to know, to understand, to comprehend, and to have knowledge. There are two opinions related to teaching and learning theory, namely: 1) behaviorism, it is stated that the students learn from the fact; and 2) constructivism, which is emphasizing on meaningful learning;

students construct their knowledge through a continuous interaction with their environment. Learning mathematics which oriented on the constructivism has three specific characters, they are: a) the students are active in their learning process; b) the materials given in the class activity are correlated each other so students will comprehend more related what they learn; c) the learning focuses on problem solving. By having those three characters of constructivism, the students are expected to have more meaningful mathematics knowledge by understanding or comprehending the concepts, procedures, and situations of a subject matter.

3.2 Curriculum of Mathematics which is Implemented in School

Since 2004 all schools in Indonesia, no matter elementary school, junior high school, or senior high school have implemented curriculum 2004 which is also called as competence based curriculum (KBK). Further this curriculum is completed by some improvements causing new curriculum called as curriculum 2006 or school-based curriculum (KTSP). Based on the previous study on documents and the result of interview with the teachers, it is found that the "Laboratorium" Junior High School has implemented the school-based curriculum (KTSP); a curriculum that is created and developed by considering the school real situation and condition. The implementation of this curriculum is based on the characteristic and condition of students where they learn. As stated by the mathematics teacher there.

Our school has implemented school-based curriculum (KTSP) pak, the time allotment for teaching and learning is adjusted to school condition; in the curriculum, every week there are 5 hours for mathematics course, but for our school we have 6 hours. It is because the students' input in our school is low comparing to other public school. By having this additional hour we expected that the students' ability is not left behind to other schools, especially the public school.

Looking at the above teacher's statement, it shows that each of school is allowed to create its own curriculum based on the school condition to improve students' achievement.

Curriculum is regulated in the Government Regulation No. 19 of 2005 concerning Standard of National Education, Regulation of Minister of National Education No. 22 of 2006 concerning Content Standard, and Regulation of Minister of National Education No 23 of 2006 concerning Graduate Competence Standard and the Implementation. Based on these regulations and the guidance written by Bureau of National Standard Education every school is being able to develop its curriculum based on characteristic, society, culture, and students' condition. In addition, the school is allowed to create and develop its curriculum by considering the school condition as an important part of learning achievement. Including for mathematics course, every school can develop its curriculum based on its surrounding especially related to its students ability.

3.3 Teaching Model which is Implemented

As stated in curriculum 2004 that the teaching model used in teaching and learning process in classroom activity is constructivism teaching model; so that, the teaching and learning process is not centered on teacher anymore, but it is centered on the students. However, the reality shows a contrast phenomenon; most schools do not implement the teaching model suggested by the curriculum, including the "Laboratorium" Junior High School where the writer conducts this study. Generally, the teacher uses traditional model, lecturing, on her/his teaching in classroom activity. Besides, teacher also gives question-answer session, task and work-sheet accomplishment on her/his teaching and learning process. The reason why the teacher uses lecturing model in her/his teaching is stated as follow.

I use lecturing model, pak. Because the student input is from low category. It will be difficult to ask them to learn independently, so I have to speak more during my teaching. Although, I speak more in my teaching, still most of my students do not understand about the material. Hopefully, through this teaching model proposed by pak Dwi, the students will enjoy their learning and off course their achievement will improve also.

From the above statement, it shows that the teaching and learning process in this school does not apply constructivism teaching model as suggested by the curriculum. The teacher still uses traditional model, teacher-centered teaching model. So, it is clear that the teacher does not apply the model suggested by the curriculum; moreover, there are no strategy variations implemented by the teacher.

3.4 The Process and the Result of Development

As explained above that this study is to create a teaching model for realistic mathematics by implementing cooperative learning in the classroom activity, so in this study there will be a teaching activity discussion.

The process of this study is done by following stages: a) preliminary study; b) designing the model; c) model realization; d) practical assessment; and e) model effectiveness. Those stages are explained as follow.

The preliminary study is done to discuss about theories related to the teaching model is going to be implemented; theory about teaching and learning, theory about the model of teaching and learning; and teaching and learning discussion. Further, it will discuss about the implementation of teaching and learning done in the school where the writer conducts this study. During doing the study, the writer takes a look at the existed curriculum and students' condition.

Since 2004 all schools in Indonesia have implemented curriculum 2004 which is also called as competence based curriculum (KBK). Further this curriculum is completed by some improvements causing new curriculum called as curriculum 2006 or school-based curriculum (KTSP). Based on the previous study on documents and the result of interview with the teachers, it is found that the "Laboratorium" Junior High School has implemented the school-based curriculum (KTSP); a curriculum that is created and developed by considering the school real situation and condition. As stated by the mathematics teacher that the school has implemented school-based curriculum (KTSP) for six hours every week, although the time allotment for teaching and learning mathematics in the curriculum is 5 hours for every week. It is done because the students' input in this school is low comparing to other public school. By having this additional hour, it is expected that the students' ability is not left behind to other schools.

The next finding is teaching and learning process in this school. It is found that the teacher in this school still uses the conventional teaching model. The teaching and learning process is mostly dominated by the teacher while the students are as teaching object. The teacher thinks that she/he has responsibility to transfer all materials to the students by using lecturing model and indeed the students must accept all what the teacher has given.

In addition, it is found that in the implementation of teaching and learning process, the teacher uses some teaching and learning components, for the example is student work-sheet which is developed by the teacher her/him self. In fact, this student work-sheet is a summary of materials given before and completed with exercises, so there is no teaching method variation done by the teacher. That is why; it is true that the students' learning achievement for mathematics course is low.

Furthermore, the model designing is done based on the result of the preliminary study, so it will have a strong foundation to be implemented appropriately in the school. The model designed is completed with student book, lesson plan, and model manual book. This model is accordance with the concept of cooperative learning as the teaching and learning strategy. In addition, there is an instrument to evaluate the model validity, practicality, effectiveness, and other components. This instrument consists of eight instruments which are divided into three main instruments. The first is (a) the instrument used to evaluate the book and its components. This instrument consists of three instruments, namely: (i) the instrument for model evaluation; (ii) the instrument for student book evaluation; and (iii) the instrument for lesson plan evaluation. The second is (b) the instrument used to evaluate the model practicality. This instrument consists of two instruments; they are (i) the instrument used for evaluating the teaching and learning process; and (ii) the instrument used for evaluating the model implementation. The third is (c) the instrument used to evaluate the model effectiveness which consists of three instruments, namely: (i) the instrument for evaluating the students' activity; (ii) the instrument for evaluating the students' learning achievement; (iii) the instrument for evaluating the students' respond toward the teaching and learning process.

The next step is to evaluate the instruments' validity and reliability by using expert validity. Based on the expert, it is found that those eight instruments have fulfilled the validity and reliability requirements. The instrument for evaluating students' learning achievement which consists of nine questions is validated by the expert using question testing, while for its reliability, there is a trial for it. To decide its validity and reliability, it uses majority criteria. Majority criteria happen when more than half of the experts state and agree that the question is valid. From the expert validity, it is found that there are two questions need to be revised, question number 5 and 8. The revision is related to the language used in the questions that seem to be difficult to be understood by the students. After revising the questions, the result is still consulted with the competent expert, and then a test of mastering the material is tried to student in 8F grader.

From this try out, it is found that the coefficient value for reliability is $r = 0.698$. From this try out, the question number 5 is deleted, so the number of question test used on the try out is eight items. It consists of question number 1 to 9, but for number 5 is deleted. Because r is $0,698 \geq 0.60$, so these questions' reliability is reliable. On the same word, it can be stated that the instruments are fulfilled the requirement of validity and reliability.

The next finding is realization of teaching model and its components. The model implemented is the book model and its components, they are students' book and lesson plan. To evaluate the book's validity, the students' book

validity, and lesson plan validity is used the instrument has fulfilled requirement of validity and reliability. The finding shows that the model book, the students' book, and the lesson plan have been examined by the expert have fulfilled the requirement of validity and reliability, but there are some revisions.

After revising the model book, the students' book, and the lesson plan based on the expert's suggestion, the next stage done is having a try out for these instruments. The try out is done to evaluate the model's practicality and effectiveness. Model's practicality is evaluated by instrument which related to teaching and learning process. Besides, it also uses instrument of model implementation. While, for the model's effectiveness is evaluated by three instruments involving students' learning achievement, students' activity, and students' respond toward teaching and learning process.

On the first try out, it is found that the model has not fulfilled the criteria of practicality and effectiveness. There is a component causing the model does not fulfill the criteria of practicality; it is component of main stage on the teacher's activity. It is found that the main stage's average score is 1.36, and based on the criteria of practicality have been decided before its average score does not fulfill the criteria of practicality. In addition, the component causing ineffectiveness is students' activity in expressing idea. It is found that the average score of students' way to express idea is 9.6 meaning it does not fulfill the criteria of effectiveness. Besides, students' achievement is also used to evaluate the model's effectiveness. On the first try out, it is also found that the students' post-test score is 70.80. It shows that it also does not fulfill the criteria of effectiveness.

Because the first try out does not show a success, so there is second try out. On the second try out, the average score of the main stage is 1.75. It means that there is an improvement from the previous try out (the previous try out average score is 1.36), so it has fulfilled the criteria of practicality. Further, students' learning outcome and students' activity are used to evaluate the model's effectiveness. It is found that the average score of students' learning outcome is 78.46. It means that it fulfills the criteria of effectiveness. Moreover, the average score of students' way to express idea is 10.4%, it also fulfills the criteria of effectiveness. On the other words, it can be concluded that the development of realistic mathematics teaching and learning model using cooperative learning strategy has fulfilled the criteria of validity, practicality, and effectiveness. Although it has fulfilled the criteria of effectiveness, but there is an item on students' activity that does not fulfill the ideal criteria of effectiveness; it is students' way to express idea.

4. Conclusion

This study is able to analyze the process and the result of creating realistic mathematics teaching and learning model using cooperative learning strategy and implement this model in classroom activity. As the result of research and development study, PMRBK is a teaching model can be used for teaching some mathematics materials, such as: square and square root of numbers, and Pythagoras theorem.

Looking at the second try out result, the teaching and learning model has fulfilled the criteria of validity, practicality, and effectiveness. There is an item of students' activity needs to be improved, it is the students' way to express idea which has 10.4%. It is still under the ideal criteria (15%). That is way; this model should be used by teacher by focusing more on the students' way to express idea. Nevertheless, the result of this study can be used as a model to improve the quality of mathematics teaching and learning through upgrading teacher professionalism

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