

Humanistic Mathematics Learning With Creative Problem Solving Assisted Interactive Compact Disk to Improve Creative Thinking Ability

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Abstract

The aim of this research is to know implementation of humanistic mathematics learning with Creative Problem Solving models assisted interactive compact disk to improve creative thinking ability of students on the prism and pyramid materials Grade VIII which are practice and effective, by valid devices. This is a development research by 4D models which is modified to 3D model. Learning device that was developed consists of Syllabus, Lesson Plan, Worksheet, Interactive Compact Disk and Creative Thinking Ability Test. It was conducted at SMPN 19 Semarang by selecting a sample of two classes with cluster random sampling. The results show that the classification for developed devices are valid. It is also practically increase creative thinking ability by showing the student and teacher responses were positive. Beside that, its also achieve the minimum mastery learning criteria averagewise and proportionalwise even better than control class. Attitude and process skill give positive influence towards their creative thinking ability, and there is an increasing student's creative thinking ability of experiment class. Based on the achievement of these four indicators, the learning is applied effectively.

Key Words: Humanistic, CPS, Interactive Compact Disk, Creative Thinking Ability

1. Introduction

The study results mentioned that despite an increase in the quality of education is quite encouraging, but learning and understanding of junior high school students in several subject matter included mathematics showed unsatisfactory results. Trend learning in junior high school usually use text book oriented and less related to the daily life students. Learning tends to abstract with discourse model so that concepts academic can be less or difficult to understand. Many teachers in teaching is still less attention to thinking skills students or in other word don't do meaningful learning, the model that used have not variety, and study pattern tend to memorize and mechanistic (Widdiharto, 2004).

Mathematics need to be given to all learners from the primary school to equip learners with a logical thinking ability, analytical, systematic, critical, and creative, as well as the ability in cooperation. Therefore, the learning of mathematics in school need to develop a learning model that directly or indirectly can improve the creative thinking ability. In addition, the creative thinking ability is required to solve problems in everyday life. Developments of technology and information can't be separated from creative thinking ability of human (Siswono, 2008). Creative thinking ability is the ability in generating a lot of the possibility of answer or a variety way in solving problems (Siswono, 2007). Indicators of creative thinking ability in mathematics according to Munandar (1999) consist of four aspects that are fluency, flexibility, originality, and elaboration.

Interviews with one of mathematics teacher in SMPN 19 Semarang, Indonesia explained that the attitude of students in study prism and pyramid matter is still less good. Students tend to be lazy when studying the material in class because they feel bored with learning models that applied by teacher. Consequently students don't understand and don't occur effectively learning. Teacher is also more often use a usual written test with routine problems than using the problems that can explore the creative thinking ability of students. This situation makes students tend to be passive so that less use of their process skills. Learning devices of mathematics in SMPN 19 Semarang is still undeveloped. Learning devices already exist, but only a formality to meet the demands of the administration, so it has not lead to learning activities that can improve creative thinking ability of students. Moreover, teachers are still rarely uses the media in learning. This has an impact on the poor ability of creative thinking of students, both individually and classical.

Based on the explanation above require attention and creativity of teachers to implement an appropriate learning process that can improve creative thinking ability. The learning process should involve all parts of students ability include cognitive, affective, and psychomotor, so that students can use her/his existing knowledge to construct new knowledge.

Drost (1998) say that one of the important ideas in humanistic mathematics learning is students can construct their understanding in learning. As described by Gage and Berliner in Oates (2011) there are five basic objectives of the humanistic view of education: (1) promote positive self direction and independence (development of the regulatory system), (2) develop the ability to take responsibility for what is learned (regulatory and affective systems), (3) develop creativity (divergent thinking aspect of cognition), (4) curiosity (exploratory behavior, a function of imbalance or dissonance in any of the systems), and (5) an interest in the arts (primarily to develop the affective/emotional system).

One of learning models that can be used to improve creative thinking ability is Creative Problem Solving (CPS). Initially developed by Alex Osborn and Sidney Parnes in the 1960's, the CPS model is an established and applied method for teaching critical teaching skills and metacognitive strategies, particularly in the realm of gifted education (Chant, Moes, and Ross, 2009). Treffinger, Isaksen, and Dorval (2003) state that creative problem solving is a model help you solve problems and manage change creatively. Through the application of CPS model, students can choose and develop their ideas. Habituation students use creative ideas in problem solving is expected to help students can improve their creative thinking ability.

Preliminary study of relevant research to CPS as model learning shows that learning with this model can promote students in any aspects. The results of Cahyono (2009) study show that CPS model is an effective model, student centered, skill process and student activity give positive influence to learning outcome. Asikin and Pujiadi (2008) say that the use of learning devices with CPS model can fulfill the effectiveness indicators and it is recommended use by teacher in the classroom. Teachers should provide more opportunities for students to solve problems in the form of problem solving.

Macaulay (2003) assumes that multimedia has properties that can aid learning, particularly the learning of abstract subject matter. The performance scores of two groups of 18 children were recorded immediately before and after using either multimedia or no multimedia to learn mathematics. The children that used multimedia scored significantly higher than those who did not. This information suggested that the people who used computer based multimedia instruction performed better in terms of test scores, compared to those who received instruction through traditional classroom lectures. One of multimedia that can be used in learning process is interactive Compact Disk (Interactive CD). Interactive CD is familiar in society. This media have characteristics that able to improve student activity to learn among other shapes and attractive colors, make students interested to learn, and the most important can clarify the concept for students. It also use as learning media at home, because interactive Compact Disk consists of material that can be learned by students and consist of task that must done by students.

Based on this background, the research questions of this study are: (1) how to develop the valid learning devices of humanistic mathematics learning with CPS assisted interactive CD?; (2) how to develop the practical learning devices of humanistic mathematics learning with CPS assisted interactive CD?; and (3) how to develop the effective learning devices of humanistic mathematics learning with CPS assisted interactive CD able to improve creative thinking ability of junior high school students?

The purposes of this research are: (1) to develop humanistic mathematics learning with CPS Assisted Interactive CD which can be implemented in junior high school; (2) to develop humanistic mathematics learning with CPS Assisted Interactive CD which is valid; (3) to develop humanistic mathematics learning with CPS Assisted Interactive CD which is practical, and (4) to develop humanistic mathematics learning with CPS Assisted Interactive CD which is effective.

2. Method

This is an R&D research to develop humanistic mathematics learning with CPS Assisted Interactive CD on the prism and pyramid materials. The learning devices include: syllabus, lesson plan, student's worksheet, interactive CD, and test of creative thinking ability. The research instruments include validation sheet of syllabus, lesson plan, student's worksheet, interactive CD, and test of creative thinking ability; observation sheet of process skill, class organization, and learning quality; questionnaire of attitudes, students, and teacher responses.

2.1 Research Variable

The variables within this research are: kinds of learning devices, creative thinking ability, attitudes, teacher ability in organizing class, student's responses, teacher's response, and quality of learning.

2.2 The Development Model

The development of learning devices in this study refers to the model Thiagarajan, Semmel & Semmel (4D) is modified into three stages (3D) that is definition, design, and development. (1) Stage 1: Define. Defining stage aims to determine and define the terms of learning devices. The activities carried at this stage include front-end analysis, learner analysis, task analysis, concept analysis, and specification of objectives. (2) Stage 2: Design. This stage aims to design learning devices and study instruments. The activities carried at this stage include criterion-test construction, media selection, format selection, and initial design. (3) Stage 3: Develop. The aim of this stage is produce a final draft of the learning devices. The activities carried at this stage include expert approval and developmental testing.

The research population was the students of grade VIII of SMPN 19 Semarang which consists of 8 classes with a total population is 241 students. The research sample groups which taken by using cluster random sampling were class VIII E as the experiment class, class VIII G as the control class, and VIII H as the trials instrument class. In experiment class, students get the humanistic mathematics learning with CPS assisted interactive CD (E). In control class, students get expository learning model or in other words are not given a special treatment (C). Then at the end of lesson the sample groups were given a creative thinking ability test (post test: O) with same instrument. Research design of this study is true experiment design type posttest-only control design.

Methods of data were used collection use test, questionnaire, and observation. This study used test method to descript score of student's creative thinking ability as post test, questionnaire to determined attitude, student's responses, and teacher response, observation to observe learning process and process skill in experiment class.

The data was analysis by using several techniques as follows: (1) the validation result was analyzed by using descriptive statistics; (2) the test of creative thinking ability was analyzed to determine the validity of items, reliability, discriminating power of items, and difficulty level; (3) the data of practically was analyzed by using descriptive statistics; (4) the effectiveness of learning process was analyzed by using normality testing, homogeneity, one sample t-test for creative thinking ability mastery testing, independent sample t-test for creative thinking ability of experiment and control class, analysis for improvement of creative thinking ability in experiment class according to Hake (1999) from pretest and post test by using Normalized Gain $\langle g \rangle$.

3. Result and Discussion

The result of validation suggests that each of learning devices is categorized as excellent with a little revision. The average score of the syllabus, lesson plan, student's worksheet, interactive CD, and test of creative thinking ability were 4,38; 4,32; 4,35; 4,35; and 4,18 from the maximum score was 5.

The learning devices that has been revised in accordance with the advice of expert, then tested to obtain inputs to revise the learning devices. The test of creative thinking ability has been revised and tested several times, and finally we gain a valid, reliable, has a significant discriminating power, and a normal level of difficulty.

Learning process in this research has been done in SMPN 19 Semarang. Implementation of learning process in experiment and control class each held five meeting, with one meeting is two hours of lessons. Four meeting were used for learning and one meeting was used to give creative thinking ability test. During the learning process, carried out the data collection include observational data of process skill and questionnaire data attitude of students toward mathematics.

The application of humanistic mathematics learning with CPS assisted interactive CD in experiment class is done by the appropriate stages. Humanistic mathematics learning with CPS assisted interactive CD begins with students grouped according to group that have been established at previous meeting by the teacher which consist of homogeneous capabilities of students. Each group studied interactive CD that has been given by the teacher, and then work together to solve problems presented. Teachers act provides guidance to students in order to solve the problems. At this stage implemented humanistic values, namely cooperation, mutual respect, and responsibility.

Humanistic mathematics learning with CPS assisted interactive CD includes the following phases.

(1) Clarification of the problem

After delivering learning materials, students join the group and accept the problems that must be solved. The teacher explains to students about the problems faced so that students can understand what it is the expected completion.

(2) Brainstorming

After obtaining an idea to solve the problem, students are given the freedom to express an opinion on a wide range of problem solving strategies are obtained. Teacher verbally directing, guiding learners find a pattern emerging relationship, and stimulate student idea to get a variety of ways or strategies to solve the problems. Students are given the freedom to think and discuss and optimize social interaction.

(3) Evaluation/selection

Every group discusses the opinions or strategies suitable to solve the problem. In this phase the teacher encourages students in the group activities.

(4) Implementation

Students determine which strategies can be chosen to solve the problem, and then apply them to find solutions to that problem. After the discussion is finished and the problems have been completed, each group presented the results of their discussion and get advice or criticism of other groups and teacher, in order to obtain the appropriate completion related to the problem. Furthermore, teacher together students make a conclusion.

At control class given by expository learning. Teacher is more active as informers so that students just listening explanation the teachers and they can't find solution the problems from discussion. The students do the problems and think the answers individually. This condition make

students can't ask or share with other friends, so they had difficulties to solve problems. In this class interactive CD didn't use, so student not too interested in learning process.

Based on the preliminary of data analysis, normality test gave conclusion that the data is normal distributed. Based on the test of homogeneity and t-test were inform that the data was homogeneous and no mean difference. It is mean that the condition of samples were same. In other word, the samples have same ability.

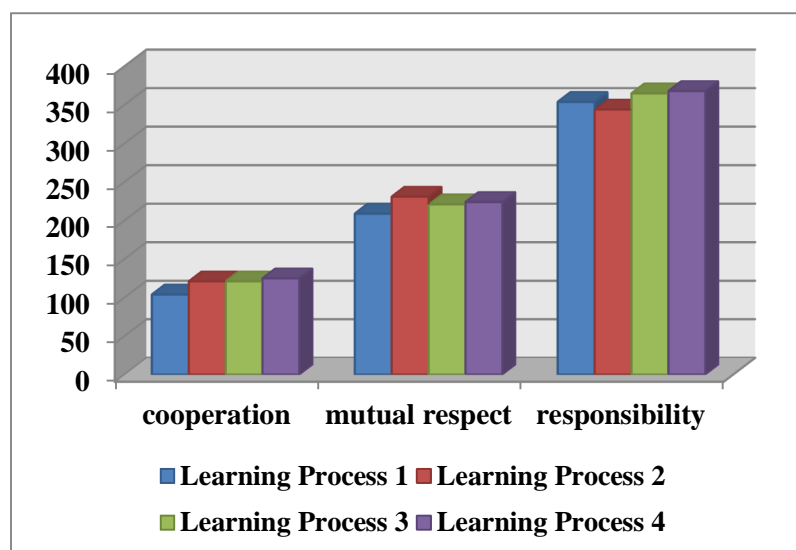
After preliminary of data analysis, each group of sample was given different treatment. In experiment class was given humanistic mathematics learning with CPS assisted interactive CD while in control class was given expository learning. After the treatment of the samples, was gained final data i.e. the results of questionnaire about attitude, the results of observation skill process in learning, and the results of post test of creative thinking ability students,.

Based on the analysis, the average value of the attitude of students towards mathematics after following study using the humanistic mathematics learning with CPS assisted interactive CD is 75,62. It is meaning that the attitude of students towards mathematics relatively positive. This is because by using the humanistic mathematics learning with CPS assisted interactive CD teacher can develop positive relationships with students and develop classroom activities that involve active pressure of the learning process as well as the participation of students in the classroom. These results are consistent with research Yara (2009) which revealed that a positive attitude towards mathematics students can be influenced by the attitude and teaching models used by teachers. Without interest and personal effort in learning mathematics students, they can't perform well in mathematics.

Through the characteristics of humanistic class created by the teacher using the stage of CPS assisted interactive CD was found that during the four meeting, the average process skills of students quite well. It can be seen from the average of each indicator reached a maximum range of 3,37 out of 5. This process skills appear use of the humanistic mathematics learning with CPS assisted interactive CD, so that the spirit of students to learn increases. This is because students can actively collaborate with other students in order to solve problems through several alternatives.

Special skills related to cultivation process humanistic values obtained data of scores of cooperation, mutual respect, and responsibility from the first to the fourth meeting are presented in Graphic 1 below.

Graphic 1. Observation Results of Humanistic Values



Based on Graphic 1 it can be seen that the ability of cooperation and responsibility of students from every learning process point higher, although still need to be improved. While for mutual respect has started well embedded in the self students. It is also seen in the number of process skills scores of students when doing the homework independently at home. This shows that students have a high sense of responsibility for what is given to them.

Based on the creative thinking ability score of students who given humanistic mathematics learning with CPS assisted interactive CD are pass classically. The score limit to pass individually the test is 70 and at least 80% of students pass the test to pass classically. The data is analyzed by one-tail proportion test to know whether the experiment class can pass classically or not. From the calculation of proportion test, gained $z = 1,76$ and with significance level of 5% is obtained $z_{0.5-\alpha} = 1,64$. It is obvious that $z > z_{0.5-\alpha}$, so that H_0 is rejected which mean the proportion of creative thinking ability students in experiment class reach 80%. The number of students who pass the test is 27 out of 29 students. Based on the calculation, 93% of students pass the test. This information show that students in experiment class could pass the test classically and individually. So, the class given by humanistic mathematics learning with CPS assisted interactive CD could pass classically and individually.

The results obtained will support research by Asikin and Pujiadi (2008) states that the use of CPS model assisted interactive CD can achieve mastery learning. This is possible because CPS assisted interactive CD students can actively participate in learning activities and are motivated to solve problems presented, either individually or in groups. The division of members of the group with heterogeneous capabilities student, also enables students to exchange ideas and to argue, then they can find a solutions together. This activity will help in student's thinking ability.

Based on calculation through the one tail t-test from the score of student's creative thinking ability in experiment and control class gained that the value of $t = 8,21$. With a significance level 5% the value of $t_{(0,95)(56)} = 1,67$. This is obvious that $t > t_{(0,95)(56)}$ which mean H_0 is rejected. So, the student's creative thinking ability in experiment class is better than the student's creative

thinking ability in control class. This information show that the student's creative thinking ability in humanistic mathematics learning with CPS assisted interactive CD is better than the student's creative thinking ability in expository learning.

The result of comparative tests of creative thinking ability of students above accordance with the results of research by Cahyono (2009) where the CPS model is a model for effective learning and student centered so it can be a powerful influence on learning outcomes. These results are also consistent with the results of research Macaulay (2003) who showed that multimedia has properties that can help in learning process, especially mathematics learning, and students who used multimedia to have higher scores than those who did not.

Multiple regression equation from attitudes and process skills to student's creative thinking ability as follows $\hat{Y} = 24,340 + 0,195X_1 + 0,571X_2$. It is meaning that each additional attitude variable (X_1) of the unit it will add value of creative thinking ability variable (Y) 0,195 and each additional variable process skill (X_2) is a unit there will be a value addition creative thinking ability (Y) of 0,571. The regression equation is quite convincing as the significant value to both the attitude and process skill of consecutive 0,032 = 3,2% and 0% less than 5%.

Regression test results regarding the influence of attitudes and process skills to student's creative thinking ability shows that the attitudes and process skills jointly affect positively on student's creative thinking ability. This positive affect may occur because of the emergence of positive attitudes towards mathematics students. Then the process skills and they will also evolve mentally, so that will improve their creative thinking skills. Meanwhile, Cahyono (2009) in his research also highlights the influence of process skills to learning outcomes of students. According to the result of his study showed that the process skills have a positive influence to learning outcomes by using CPS model. So, the attitude and the process skills are two variables together to give influence to improve creative thinking ability of students.

The result of the increase in student's creative thinking ability get an average Normalized Gain $\langle g \rangle$ by 41%, which means interpretation of the increase occurring creative thinking ability in medium category. Increased student's creative thinking ability can occur due to learning by using humanistic mathematics learning with CPS assisted interactive CD refers to the administration of a matter or problems and let students construct their own knowledge to solve the problems, so that help students develop the thinking process. This is in accordance with the opinion Pepkin (2004) states that by using CPS students can choose and develop ideas and thoughts. In contrast with memorize that use a little of taught, CPS expand the thinking process.

4. Conclusion

The learning devices development of humanistic mathematics learning with Creative Problem Solving Assisted Interactive CD to improve creative thinking ability in grade VIII on prism and pyramid matter in this study has been declared valid after getting validation from a team of experts and peers. The learning devices produce a practical learning based on the responses of students and teachers were positive. The results of the analysis have achieved effective indicators, that are: (1) creative thinking ability of students in experiment class has reached classical completeness criteria, (2) creative thinking ability of students in experiment class is higher than control class, (3) attitude

and process skill have positive influence to creative thinking ability, and (4) there is an increasing creative thinking ability in experiment class by 41%. From this results, it is recommended for the teacher to implement humanistic mathematics learning with Creative Problem Solving Assisted Interactive CD to improve creative thinking ability in grade VIII on prism and pyramid matter.

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