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Associations Between Students' Prior Knowledge with Critical and Creative Thinking Ability on Mathematics Junior High School Students Through Problem Based Learning and Cognitive Conflict Strategy

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Abstract

Students' Creative and critical thinking ability on mathematics is an important component that must be owned by a student, so having this help students in solving mathematical problems, as wellas every day problems. One way to develop these ability through problem-based learning is the cognitive conflict strategy (PBLCC). Researchers are interested to see and examine the association of students' prior knowledge (PAM) with the ability to think critically and creatively mathematically. Keywords: Problem Based Learning, Cognitive Conflict Strategy, Critical and Creative Thinking ability on mathematics

I. Introduction

From various studies, both international and national scale it appears that the quality of education in Indonesia is still low. It can be seen from the Human Development Index (HDI) which is issued by UNDP. One of the indicators in determining the HDI is the quality of education in a state of primary to secondary school level. Indonesian HDI was only 0.728 from the ideal value and Indonesia was ranked 107 out of 177 countries measured. Junior high school students' mastery of mathematics in Indonesia revealed by the reports of The Trends in International Mathematics and Science Study (TIMSS) 1999, 2003, and 2007 of the results of the TIMSS study shows that Indonesia is still ranked than expected. In line with the results of TIMSS, the results of tests Programme for International Student Assessment (PISA) 2003 and 2006, coordinated by the Organisation for Economic Co-operation and Development (OECD) showed similar results. TIMSS and PISA results revealed that the Indonesian junior high students' mathematical ability for non-routine matters and understanding of the concept is still very weak, but relatively good in fact solve the problems and procedures (Mullis et al, 2000, 2004, 2008).

The average value of National Examination (UN) Mathematics high school students in the province of Central Sulawesi nationally can be said is still low at 6.11 in the academic year 2006/2007 and 5.58 in 2007/2008 academic year. When viewed in terms of national rankings, Central Sulawesi Province is ranked 30 in the know 2006/2007 and ranked 29 in the academic year 2007/2008 of 33 provinces in Indonesia. The low result math indicates that something is wrong and not optimal in the learning of mathematics in schools. This is in line with the results of research conducted Sullivan (1992), IMSTEP-JICA (1999), Sutiarso (2000), Armanto (2002) and Dahlan (2004). Their results revealed that the students' learning of mathematics in schools tend to be passive, prioritize drill and mechanistic, centered on the teacher (teacher oriented),

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chalk and talk. Teachers as one of the centers in the learning process in the classroom is still the view that learning is a process of knowledge transfer (transfer of knowledge) of teachers to students.

According to Piaget, cognitive development process we have always interacted with their environment through processes of assimilation and accommodation. If assimilation and accommodation occur freely or without conflict, then the cognitive structure is said to be in a state of balance (equilibrium) with its environment. However, if there is a conflict then one is in a state of balance (disequilibrium).

Mathematical problem solving is one of the five NCTM process standards set forth, in addition to reasoning and proof, communication, connections, and mathematical representations (NCTM, 2000: 29). Problem solving is the highest thought process (Rusefendi, 2006: 166) and is the central focus of the mathematics curriculum (Kirkley, 2003: 1). Mathematical learning process that facilitates the development of this ability can train students to develop the fullest potential of thinking that has the ability to think logical, analytical, systematic, critical, creative, and productive. Unfortunately, the process of learning mathematics is still not seek the establishment of this capability to every student.

In practice, the teacher started teaching mathematics to explain the material through an example of a routine matter. Learning materials is less related to students' daily activities or situations that can be imagined students. This learning process as too mechanistic, which leads to, among other things, the students are less active in the learning process, less retention, less skilled in problem solving, and the potential of thinking they are not growing, awareness of the use of mathematics in solving the problem of life is not implanted. And low student math learning outcomes, not according to expectations.

II. METHODS

This study was a quasi-experimental research, where researchers conduct giving treatment to the subject of research for further wanted to know the effect of the treatment. Such treatment is problem-based learning with the cognitive conflict strategy (PBLKK) in the experimental class and the conventional learning (KV) in the control class class. The independent variable in this study is problem-based learning approach with cognitive conflict strategy (PBLKK) and the conventional learning (KV). Classes are taught by PBLKK an experimental class, while the class is taught by conventional teaching (KV) is a control class. The dependent variable in this study is a mathematical critical thinking skills, mathematical creative thinking abilities. Control variable in this study is the beginning of knowledge (student prior knowledge) mathematics students (PAM), and school levels. School level selected in this study based on the data from the school ranked national examinations (UN).

Subjects Research

The population in this study are all junior high school students in the city of Palu in Central Sulawesi. Determination of study sample done first by categorizing schools into three levels, namely high school level, medium, and low based on data from the national exam (UN).

Selection of SMP as the subject of this research is based on the consideration that the junior class VIII in particular about 13-14 years old, according to Piaget at this age children are at the level of formal thought. In addition, the eighth grade students of SMP was considered ripe to receive an update on the use of learning model. Eighth grade junior high school students have had enough time to know the environment and climate of learning at the junior and already have basic math skills are relatively homogeneous. While the reasons for choosing the school with levels of high, medium and low because researchers wanted to get a picture of the impact of learning undertaken when viewed from three levels of school

III. Results and Discussion

To see the association between nominal variables in the form of data used from the contingency coefficient analysis Chi-square test ($\chi 2$) through Crosstab. Here is presented a contingency table between the initial knowledge of mathematics (PAM) with mathematical students' critical thinking skills.

Table 1: Association between PAM with Critical Thinking Mathematically Students

		Critical			Total	Contingency Coefficient	*Sig.*
		Low	**Medium**	**High**			
PAM	**Low**	**38**	18	3	59	0,502	0,000
	Medium	27	**83**	25	135		
	High	0	0	**6**	6		
Total		65	101	34	200		

On Table 1 it is known that the probability value (sig.) Siginifikansi level of less than 0.05. This means, there is a significant association between PAM students with critical thinking skills mathematically. It appears from Table 1, students with low PAM has the critical thinking skills that are also low, with PAM students are likely to have critical thinking skills are mathematical, and students who have a high PAM has the mathematical ability to think critically high.

Here are presented in Table 2, the contingency table between PAM students with mathematical creative thinking abilities.

Table 2 Association between PAM with Creative Thinking Mathematically Students

Crosstab							
		Creative			**Total**	Contingency Coefficient	***Sig.***
		Low	**Medium**	**High**			
PAM	**Low**	**31**	27	1	59	0,452	0,000
	Medium	26	**89**	20	135		
	High	0	1	**5**	6		
Total		57	117	26	200		

On Table 2 it is known that the probability value (sig.) Test Crosstab siginifikansi level less than 0.05. This means, there is a significant relationship between PAM with mathematical creative thinking abilities of students. Students with low PAM, has the ability to think kreatifyang low as well, with PAM being inclined students are also creative thinking abilities which are also mathematical, and students who have a high PAM has the ability to think creatively that high anyway. The lower initial ability math students also lower the students 'creative thinking ability, and conversely the higher the initial knowledge of the higher mathematics students' creative thinking ability.

From Table 1 and Table 2 it appears that seven students from low PAM and has a low critical thinking skills creative thinking skills turns into being. There is one student with PAM being and has the ability to think critically low turns his creative thinking skills into being.

According to Piaget, when students are in conflict (disequilibrium) students trying to find a new balance. In reaching a new equilibrium seeks to empower students understanding of concepts that have dimiliknya through how to identify, connect, analyze, try to answer the question in various ways. It will be able to build and develop the ability to think critically and creatively mathematically.

Provision of cognitive conflict in students is an attempt for students to construct and conclude a concept properly, either in its own way and through international assistance (scaffolding) friend or teacher. This is in line with that proposed by John Dewey, Vygotsky, Ausubel, Gagne, and Brownell.

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IV. Conclusion

Students with low PAM has the critical thinking skills that are also low, with PAM students are likely to have critical thinking skills are mathematical, and students who have a high PAM has the mathematical ability to think critically high.

There is a significant relationship between PAM with mathematical creative thinking abilities of students. Students with low PAM, has the ability to think creatively is also low, with PAM being inclined students are also creative mathematical thinking skills that are well, and students who have a high PAM has the ability to think creatively that high anyway. The lower initial ability math students also lower the students 'creative thinking ability, and conversely the higher the initial knowledge of the higher mathematics students' creative thinking ability.

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