A Study of Mathematical Creative Thinking Ability of Senior High School Students Through Alberta Inquiry Learning Model at Siak Watershed Area, Riau Province

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ABSTRACT

The research is aimed at examining mathematical creative thinking ability of senior high school students using Alberta inquiry learning model and conventional learning method in Siak watershed, and disseminating Alberta inquiry learning model. This quasi-experimental research used *nonequivalent control group* design. The research population was senior high school students in Siak watershed, Riau Province. Forty-six students of grade X were chosen as the samples. The data were analyzed using t-test. The research results showed that students' mathematical creative thinking ability was better increased through the use of Alberta inquiry learning model compared to conventional learning methods.

Keywords: Alberta inquiry learning model, creative thinking, Siak watershed.

Introduction

Siak watershed area has its own characteristics, where it crosses four districts and a city. The four districts and the city included to Siak watershed are Rokan Hulu regency, Kampar regency, Pekanbaru, Bengkalis regency, and Siak.

A conservation study of Siak watershed area conducted by *Bapedal*, Environmental Impact Management Agency, of Riau Province in 2005 encountered that illegal logging, domestic waste, and settlement are still problematic in the region. A research project carried out by Dwi Putri (2011) reveals that one of many factors contributing to the problems is the society's low income. This somehow indicates that society's creativity and creative thinking skills are still below average. Were they able to wisely manage and manufacture abundant natural resources in the area, people welfare would have been better. Hence, creative thinking is crucial to be developed, especially in teaching and learning processes at schools.

Developing creative thinking skill has been one of the main purposes of mathematics education. Yet, the competency has not yet been well-advanced in the field. This is proven through a study done by Kartini (2012), stating that creative thinking ability of students studying math in Pekanbaru is still low. It indirectly implies that the situation is almost identical in Siak watershed area. Teachers' lack of understanding as to the ways improving students' creative thinking skill and conventional studying habits are believed to inhibit the development of mathematical creative thinking capability. Teachers tend to merely provide the students with common questions and issues, and to some extent, emphasize more on the correct

outcome instead of good processes. Consequently, students are not really given chances to improve their mathematical creative thinking ability.

Mathematical creative thinking ability is going to arise and grow only in a conducive learning environment. Additionally, Fisher (1995) states that instilled stimulus is critical to elicit students in thinking creatively and critically. It can be given by providing challenging issues or problems at the beginning of a lesson. Therefore, teachers can actively support the development of students' mathematical creative thinking ability.

A learning model qualified for the criteria is Alberta inquiry learning model. According to Donham (in Alberta Learning, 2004) Alberta inquiry learning model consists of the phases : planning, retrieving, processing, creating, sharing, and evaluating. At the planning phase, students are directed to understand the problems clearly; on retrieving phase, students were asked to retrieve the materials relevant to the problem to be solved; problems solved at this phase of processing. At the phase of creating, students produce something, or get the solution of the problem and directed to be creative so that it can resolve more than one way. Later in the sharing phase, students in the discussion will provide and receive results from other group. In the last phase of evaluating, students review their answers, including compare their answers with their friends. If the answer is not correct, then students are directed to revise where lies the fault. The answer from the teacher will be shown only if all students can not find the right answer to the specified time limit.

Grounded on Kartini's research (2012), Alberta inquiry learning model has been proven to be successful in enhancing mathematical creative thinking ability of senior high school students, either in moderate or high-level institution. For this reason, this Alberta inquiry learning model needs to be built up and expanded in Siak watershed area.

On the basis of the issues presented above, the formulation of the problem within this research is created as follow: Is the mathematical creative thinking ability of senior high school students receiving Alberta inquiry learning model better compared to the one using conventional learning method in Siak watershed area?

In brief, the purposes of this research are: (1) to investigate mathematical creative thinking ability of senior high school students receiving Alberta inquiry learning model compared to those who only employ conventional learning method in Siak watershed area (2) to disseminate Alberta inquiry learning model.

RESEARCH METHOD

This quasi-experimental research was conducted using *non-equivalent control group* design (Sugiono, 2010). The research population was all senior high school students in Siak Regency, while the sample was 46 grade X students, consisting of two classes. The sample was selected using a *purposive sampling* technique.

The data analyzed was the mathematical creative thinking skill of students. Their creative reasoning improvement is understood from the analysis of normalized *gain* score (N-*gain*) from the *pretest* and *posttest* scores. The data distribution normality test was carried out using *Lilliefors* (*Kolmogorov-Smirnov*) normality test existed

in SPSS *Explor* procedure. Meanwhile, *Levene* (F-test) test was employed for homogeneity test. Lastly, the t-test was done by adjusting the problems.

RESULTS AND DISCUSSIONS

The average scores of students' mathematical creative thinking in the *pretest*, *posttest*, and N-*gain* are presented in Table 1. Generally, Table 1 provides information on the improvement of mathematical creative thinking ability of students using both Alberta and conventional learning models, deduced from the value of both N-*gain*, which is more than zero. However, the improvement on the use of Alberta inquiry learning model was moderate; based on Hake category (in Meissner, 2007), whereas the one using conventional model was low. In detail, students score higher subsequent to the use of Alberta inquiry learning model compared to the conventional method. Their average score was also greater because of the Alberta inquiry learning model.

Table 1. Students' pre-test, post-test, and N-gain scores

Stat	Alberta Inquiry Learning Model			Conventional Method		
	Pre-test	Post-test	N-gain	Pre-test	Post-test	N-gain
Average	**0.09**	**1.45**	**0.37**	**0.33**	**0.77**	**0.11**

Note: Maximum ideal score for pretest and posttest is 4, and maximum ideal score for N gain is 1.

The result of data distribution normality test of students' mathematical creative thinking ability showed that the improvement of both experimental class (using Alberta inquiry learning model) and control class (using conventional method) normally distributes on significant standard $\alpha = 0.05$. Furthermore, the homogeneity test yields homogeneous data on the two groups. Then, the t-test was accomplished to examine the improvement gap or the d ifference between students receiving Alberta inquiry learning model and those getting the conventional one. The results on the improvement difference are presented in Table 2 below.

Table 2**.** The improvement difference test result of students in both groups

Learning model	*N*	Ave-rage	Value Diffe-rence	t	dk	*Sig*.	H_0
Alberta	21	0.37	0.26	8.706	40	0.000	Declined
Conventi-onal	25	0.11					

Table 2 depicts that the probability value (*sig.*) is less than 0.05, thus declining the H_0. Hence, there is indeed a significant distinction on the average improvement between students studying using Alberta and conventional models. Since students' average score using Alberta model is better than those employing conventional model, it can be concluded that the scores improvement of students studying using Alberta model is better than the ones using conventional model.

The average of improvement on each mathematical creative thinking ability aspect of students in both groups is illustrated in Diagram 1 below.

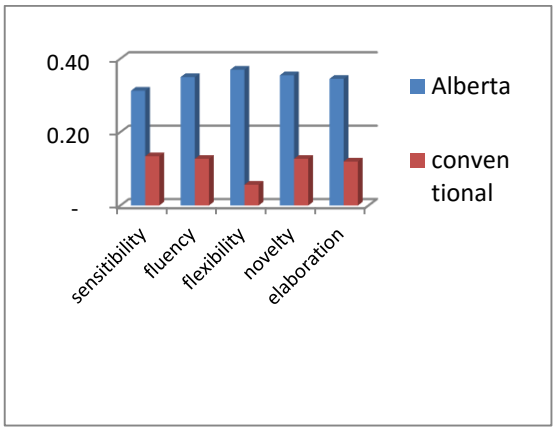

Diagram 1. Average of Mathematical Creative Thinking Ability N-*Gain* Aspects

Based on Diagram 1, it can be noticed that the average of students' mathematical creative thinking ability improvement is higher with the use of Alberta inquiry learning model compared to N-gain average of students using a conventional method in each aspect.

Despite the fact that the improvement has been obviously obtained, it is not completely satisfying. Provided that the Alberta inquiry learning model kept being continuously implemented, there would be a greater possibility to develop students' mathematical creative reasoning since in every beginning of the lesson, students are provided with stimulating issues or problems. This kind of activity can stimulate them to ponder a topic or perform a mental activity as a starting point of the learning process. In case that the given problems are not truly thought-provoking, the teacher should, therefore, assists them through a scaffolding technique.

The presented issues or problems, as mentioned above, must be corresponding to Gestalt and Piaget theory. When the students are provided with interesting topics, a cognitive conflict or disequilibrium can then be elicited. As a result, students are going to experience an equivalence process by connecting new information to their background knowledge and so an assimilation process occurs. Meanwhile, the accomodation progression happened at the time the students gain recent and novel information.

After the problems are delivered, the students are demanded to actively understand the issues, pose questions, design solutions, create a mathematical model and complete them using as many ways as possible. Hereafter, the students compare and evaluate their answers with other peers. To solve the problems, students have to explore the mathematical ideas, collect information and then select which evidence is possibly effective to cope the problems. In this way, students are trained to perform mathematical practices.

A habit of investigating mathematical ideas will be very likely to provoke students trying various alternative solutions. As they are used to thinking of solutions, there will be better chances for them to generate novel and distinctive ways of resolving a problem. With this structure of activity, three aspects of mathematical creative thinking (fluency, flexibility, and novelty) can be developed.

In Alberta inquiry learning model, students are demanded to understand a problem, ask questions, plan solutions, create and complete a mathematical model through numerous methods. Those activities are steps taken in solving a problem as suggested by Polya (1973). The activities are useful to accustom students to detect and respond to a problem. In other words, such a habit and practice are valuable to train students' creative thinking, specifically about their sensitivity to an issue. Further, when the students compare and evaluate solutions to a problem with their friends, they have implicitly advanced their evaluation skills. As for elaboration ability, it can be improved

while completing and specifying answers the students have written.

Unlike Alberta inquiry learning model, the conventional model of learning is usually marked by teachers' activities like explaining a concept, a fact, an example and a procedure directly to students. Then, students are given questions that are almost similar to the ones presented previously by the teacher. On the other hand, in Alberta inquiry learning model, the materials are not immediately provided, but students are required to actively discover concepts, facts, and procedures. This is in line with a learning theory developed by Bruner, that is the constructivist theory. Constructivist theory (in Hudoyo, 1988) exposes that the best thinking method for students to comprehend a concept and a principle in math is by initially constructing their very own concept and principle of the studied material.

In addition, a concept in math will be meaningful only if it is compared to other concepts. The notion is supported by Bruner's connectivity theory, saying that every concept, structure, and capability in math should be associated with other concepts, structures, and capabilities. Therefore, students are mentally and vigorously participated in finding possible relations between concepts and structures in math. Yet, this role can thoroughly be accomplished if students have uncovered ways to find "how to find the relation". Students may find regularity or irregularity of studied materials, thus allowing them to organize and manage problems. It may lead them to easily understand the concept, structure, and formula of scrutinized materials.

In a nutshell, Alberta inquiry learning model allows and helps students in building and fortifying their understanding of a lesson better than conventional teaching and learning method. With profound comprehension, students' mathematical creative thinking capability will, therefore, be increased and honed.

Based on those research results, it can be summed up that the implementation of Alberta inquiry learning model can increase students' mathematical creative thinking ability. This result is similar to the findings of a research project conducted by Kartini (2012).

CONCLUSION AND SUGGESTION

On the basis of the research results, it can be concluded that students using Alberta inquiry learning model have better improvement on their mathematical creative thinking ability compared to the ones using the conventional method in Siak watershed area. The Alberta inquiry learning model is suggested to be used as a learning model in teaching and learning process to improve students' mathematical creative thinking capability.

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