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Students' Creative Thinking Skills and Anxiety of Mathematics in an Islamic Junior High School Using Brain-based Learning

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***Abstract*—The aim of this study is to analyze the influence of brain-based learning on the enhancement of mathematical creative thinking ability and mathematical anxiety reduction. In addition, the relation between students' mathematical creative thinking ability and mathematical anxiety was studied too. The method used is quasi-experiment with non-equivalent control group design. The sampling technique is purposive sampling. Instruments which is used are pretest, posttest, observation sheet, interview and questionnaire of students' mathematical anxiety reduction. Data analysis was conducted by using SPSS 20 software. Research results of this study are (1) The enhancement of mathematical creative thinking ability of students who received brain-based learning is better than students who received conventional learning, (2) There is no difference of mathematical anxiety of students who received brain-based learning and students who received conventional learning, (3) there is negative relation between students mathematical creative thinking ability and students' mathematical anxiety.**

Keywords—brain-based learning; mathematical creative thinking; mathematical anxiety

I. INTRODUCTION

The ability of creative is becoming one of the goals in mathematics, as stated in the regulations of the national education ministry [1]. There are some of the abilities and attitudes that must be developed as a purpose of mathematics learning: (1) creative mathematical concepts; explain the link between concepts and apply concepts or algorithms in a flexible, accurate, efficient and precise in problem solving; (2) using the reasoning in the patterns and nature, perform mathematical manipulation in making generalizations compile evidence or explain mathematical ideas and statements; (3) solve problems that include the ability to creative the problem, devised a mathematical model, solve the model and interpret the obtained solution; (4) communicate ideas with symbols, tables, diagrams or other media to clarify the situation or problem; and (5) respect to the usefulness of mathematics in life, are curious, attentive, and a tenacious attitude and confidence in solving problems.

One of the strategies that can be done is to use a learning model that can maximize brain function. Learning strategy in question is by learning from the Brain-Based Learning approach. Brain-Based Learning Approach is learning that is aligned with how the brain works naturally designed for learning [2]. Planning stages of learning with Brain-Based Learning approach according to Jensen, there are: "pre-exposure phase, preparation, initiation, and acquisition, elaboration phase, the incubation stage and enter the memory, the stage of verification and checking of belief and celebration stage and integration*"* [2].

The main strategy that can be developed in the implementation of Brain-Based Learning, includes three aspects: (1) create a learning environment that challenges students' thinking skills; (2) create fun learning environment; and (3) create a situation of active learning and meaningful to students. This strategy must be well designed in learning mathematics through Brain-Based Learning approach. This approach is expected to run smoothly as planned so that learning objectives can be achieved optimally [3].

II. LITERATURE REVIEW

A. Brain-Based Learning

There are seven stages Brain-Based Learning which has been arranged in such a way [2]. They are superficial so that the teacher can still add a lot of other things into it based on the needs of each. Accordingly, Brain-Based Learning can be customized design to learn the material. Here are the steps for implementing Brain-Based Learning in the study: pre-

exposure, preparation, initiation and acquisitions, elaboration, incubation and inserting memory, verification and checking of belief, celebration, and integration.

B. Creative Thinking Skills

Briefly, creative thinking can be said as a pattern of thinking based on a way that encourages us to produce creative products. Something new here does not have to be a completely new result/creation even though the end result may appear to be something new, but it can be the result of combining two or more existing concepts.

Creative product criteria do not depend on a single trait, a new idea, but involve many components [4], including:

- Creative thinking involves the aesthetic side and practical standards.
- Creative thinking depends on attention to purpose and outcome.
- Creative thinking is more dependent on mobility than smoothness.
- Creative thinking is not only an objective but also a subjective.
- Creative thinking is more dependent on extrinsic motivation.

Creative thinking is detected in four elements: sensitivity, fluency, flexibility, and originality [5]. Sensitivity to a problem situation involves the ability to identify a problem, being able to distinguish facts that are irrelevant to the problem, including distinguishing relevant concepts on the real issue. This sensitivity includes what a person perceives in relation to the identified problem, such as related concepts, appropriate strategies for solving the problem. Sensitivity will emerge more clearly if there is some kind of stimulus provided in the problems and challenges provided by the teacher.

Sensitivity can trigger individuals to continue efforts to engage in observation, exploration so as to generate ideas. Smoothness is the ability to build many ideas easily. Smoothness in raising diverse ideas or questions and answering them, or planning and using as a settlement strategy in the face of complex problems. Flexibility refers to the ability to develop diverse ideas. Flexibility can be viewed as a variation that demonstrates the wealth of ideas and efforts of the concerned in building ideas toward the expected solution. Authenticity is the ability to generate unusual ideas and solve problems in an unconventional way. This authenticity comes in many forms, from simple or informal to later developed into more complete.

The abilities associated with creative thinking there are eight abilities, four from the cognitive domain and four from the affective sphere. The following four capabilities of the cognitive domain are mentioned in full by Williams as follows [6]:

1) Think smoothly

- Generate many relevant ideas or answers.
- The flow of thought smoothly.

2) Think flexible

- Produce varying ideas
- Able to change the way or approach
- The direction of thinking is different.

3) Original: Give unusual answers, others from others that rarely give most people.

4) Detailed

- Developing, adding, enriching an idea.
- Detailed with details.
- Expanding an idea.

Some research related to Brain-Based Learning approach, the ability of mathematical creative there are:

- Brain-based learning approach. It has been investigated the retention of students in science subjects in grade 5 elementary schools in Turkey in the academic year 2004/2005 [7]. In that study were taken two classes as experimental class and control class. Results from these studies are student achievement in the classroom using Brain-Based Learning approach better than students in learning using conventional learning, retention (memory) of students in the class using Brain-Based Learning approach better than students in learning using conventional learning.
- Comprehension and creative mathematical ability. Results of research on improving the ability of students 'mathematical creative, among others: It is found that the type of cooperative learning Two-Stay-Two Stray can improve students' mathematical creative junior high school [8]. Other study concluded that the learning constructivism Needham models can improve students' mathematical creative Vocational High School [9]. Also, it had been concluded that learning by using Geo-Algebra can improve students' mathematical creative junior high school [10].

III. METHOD

This research is an experimental design with pretest-posttest and control group by implementing the learning brain-based learning to study the ability of creative mathematics students. The method which is used is quasi-experiment with non-equivalent control group design. The sampling technique is purposive sampling. Instruments which is used are pretest, posttest, observation sheet, interview and questionnaire of student’s mathematical anxiety reduction. Data analysis was conducted by using SPSS 20 software. In more detail, the research was aimed to improve the ability of creative mathematics and anxiety mathematics students after learning brain-based learning and conventional learning and see the achievement of mathematical anxiety in both the classroom and also show a correlation between the ability creative, and mathematical anxiety. The subjects of this study were 54 students in grade 7 of one among MTs in Sumedang.

A. Data Analysis Technique

The data in this study includes quantitative data and qualitative data. The first thing to do in processing quantitative data is the descriptive statistical analysis that aims to get a general idea about the improvement obtained by the students in creative mathematical ability consisting of the maximum value, minimum value, average, and standard deviation.

Then, analysis of the ability of creative mathematically using two mean difference test. Building capacity in this study was obtained from the difference between pretest and posttest scores and scores ideal mathematical creative capabilities are expressed in a score gain normalized by the formula (1) [11].

$$\text{Gain normalized (g)} = \frac{score\ postes - score\ pretes}{score\ maximum - pretes} \qquad (1)$$

IV. Results and Discussion

The results of the analysis of the pretest, posttest, and normalized gain of students' creative ability are presented in Table 1. Based on the data in Table 1, it was obtained that there are no differences in pretest scores creative of mathematical ability of students in the second-grade math learning and entirely classified as very low. But after the learning, students learning classes Brain-Based Learning, creative mathematical ability of students reach (13,50 out of 20) and gain increased (0,61) were classified as moderate and better than achievement (11,08 out of 20) and increase (0.48) students in conventional classes are classified as lacking in creative mathematical abilities.

TABLE I. Pretest, Posttest and N-Gain Creative Students in the Second Grade Learning

	n	IMS	Class Brain-Based Learning					
			Pretest		*Post-test*		*N-Gain*	
			$\bar{x}$	*s*	$\bar{x}$	*s*	$\bar{x}$	*s*
M.U.	27	20	3,55	1,87	13,50	0,16	0,61	0,16

Class Konventional					
Pretest		*Post-test*		*N-Gain*	
$\bar{x}$	*s*	$\bar{x}$	*s*	$\bar{x}$	*s*
2,88	1,76	11,08	2,65	0,48	0,16

M.U. : Mathematical Creative

I.M.S. : Ideal Maximum Score

V. Conclusions and Recommendations

Based on the findings and discussion, this study provides the following conclusions: The ability of creative mathematical learners Brain-Based Learning is quite good, and the ability better than the ability of the mathematical creativity of students who received conventional learning is classified as moderate. Likewise, enhancements mathematical creative of students with learning Brain-Based Learning is better than an increase in the ability of students in a conventional classroom. But both the increased ability of creative mathematical equally belong to the category of being.

Based on the conclusion, some suggestions as follows. The research was conducted on students MTs. with the mathematical ability of students were classified as moderate. They take longer to learn to creative mathematical concepts and their application. Moreover, questions the ability of creative mathematical and mathematical creative in this study belong to the high level of mathematical ability. It is therefore recommended study carried out in sufficient time to allow students to learn significantly.

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