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The Effectiveness of Brain Based Learning Assisted by *Schoology* towards Students' Creative Thinking and Self-Efficacy

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Abstract

This study aims to determine the effectiveness of brain-based learning assisted by schoology for the creative thinking ability in mathematics; determine the creative thinking ability of students who were taught using brain-based learning assisted by schoology whether they were better than students who were taught using brain-based learning without schoology-assisted learning; determine students' mathematical creative thinking ability in terms of self-efficacy that are taught using brain-based learning assisted by schoology. This type of research is a mix method with a sequential explonatory design. Quantitative analysis techniques include completeness test and average difference test. The qualitative analysis technique used is triangulation. The results of this study show that the schoology-assisted brain based learning is effective in improving students' mathematical creative thinking abilities; The creative thinking ability in the experimental class with brain-based learning assisted by schoology is better than the control class with brain-based learning without schoology-assisted learning; Students who have creative thinking ability in terms of self efficacy with high category are able to meet all indicators of creative thinking. Students who have creative thinking ability in terms of self efficacy with medium category are able to meet some of the indicators of creative thinking ability. A student who has creative thinking ability in terms of self efficacy with low category is less able to meet each indicator. Learning by using a brain based learning model is an effective model to improve students' creative thinking abilities and self-efficacy, where the students have reached the minimum completeness criteria of 75 and students' classical completeness has exceeded 75%. The results from the students' answers and the unterviews on problems in the mathematics creative thinking ability test show that the students who have high self efficacy category have a very good creative thinking ability, students who have medium self efficacy category are having good creative thinking ability and students with low self efficacy category have a pretty good creative thinking ability.

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INTRODUCTION

Education is a conscious and planned effort to create an atmosphere of learning activities that shape students to actively develop their potential to have spiritual strength, self-control, personality, intelligence, noble character, and the skills needed by themselves, society, nation and state, as explained in Law Number 20 of 2003, Article 1. In article 3 the function of national education is explained, that national education functions to develop capabilities and shape the character and civilization of a dignified nation in order to educate the life of the nation, aiming at developing the potential of students to become human beings who believe and have faith to god almighty, noble, healthy, knowledgeable, capable, creative, independent, and become a democratic and responsible citizen.

Junior high school students experience a transition from the concrete operational stage to the formal operational stage so that the learning material taught is abstract material that can usually be explained concretely. Puberty or adolescence is a turbulent period because biological development occurs so quickly that it is considered the most critical period in a person's life. One problem that often occurs is the study about students who excel shows that students who are stronger have better performance than students who are weaker, students at all levels improve their thinking skills when teaching is focused on this goal Zohar & Dori (2003). This is reinforced by the opinion of NCTM (2000), in grades 6-8, students experience physical, emotional and intellectual changes so that they become an important point of change in themselves. Pessimism, negative moods, easily guilty and magnify mistakes are individuals who have low self efficacy. Students who have low self efficacy will feel difficult to find solutions to problems easily and flexibly, so creative thinking skills do not occur. Therefore, these problems can be used to train and develop students' creative thinking skills and Self-Efficacy.

The observation results of semester 4 of mathematics study program students Universitas Singaperbangsa Karawang (UNSIKA) show some indications of problems, among others because the implementation of learning is less encouraging students to think creatively. Two factors cause creative thinking not develop during education is a curriculum that is generally designed with broad material targets so educators are more focused on completing the material, and the lack of educators' understanding of teaching methods that can enhance creative thinking abilities. These are proved by the low mathematical final score in analytical subjects, which is only 32% of students who achieve good categorized scores (Rosita, 2016).

The ability to think creatively is very important for students. The ability to think creatively is one of the important abilities for the 21st century, students must acquire and apply creative thinking skills (Hong, 2014). However, the reality is that the students' mathematical creative thinking ability nowadays is still low. Fardah (2012) states that students' creative thinking abilities are still relatively low. The results of her study showed that students with creative thinking abilities in the high category were 20% of the total number of students, the moderate category were 33.33% and the low category were 46.67%. From the results of these studies, students who have low creative thinking ability are more than students who have high creative thinking ability so that it canbe concluded that the students' creative thinking ability is low.

In this regard, the same problem also occurred in SMP Negeri 2 Ambarawa, the implementation of the student learning process in SMP Negeri 2 Ambarawa through the mathematics teacher argument and evaluation data, it was encountered the problem of the low creative thinking abilities of some students. This can be seen from the low student achievement when they were given a daily test. They still feel lazy to learn mathematics because there are too many formulas. They assume that mathematics is a boring subject and still feel confused in applying mathematical concepts in daily life. Students can understand the contextual problems provided by the teacher and can communicate information from contextual problems by providing solutions

on the answer sheet, but it will still need more time in solving mathematical problems (Fauziah, 2013).

Mace & Ward (2002) developed a model of four stages of students' creative thinking, they are: (1) students try to understand a concept of creativity; (2) students develop ideas by rearranging their ideas with creative ideas, by identifying their various ideas to develop as much as possible what they think, then evaluating ideas by questioning and doing metaphors and analogies; (3) students realize ideas by transforming ideas into physical entities; (4) students conclude and apply the resolution of creativity.

This is the evident from student learning outcomes with an average value of 27.6 with a Minimum Completion Criteria (KKM) of 65. From the data it appears that the average value obtained by students has not yet reached KKM because the difference in student grades with the specified KKM is 37.5. The low student learning outcomes were due to students' creative thinking abilities in aspects: (1) fluency: is generating ideas by 38.5%; (2) originality: is having ideas to solve problems by 30.7%, and (3) elaboration is the ability to solve problems by 26.9%. From these results it can be said that students' creative thinking skills at SMP Negeri 2 Ambarawa are still relatively low. So it can be concluded that the ability of students to think creatively in solving mathematical problems is also low.

Students must also be able to have high self efficacy. Self efficacy refers to a person's belief that they have the ability to be able to succeed in carrying out a particular task. Someone, who often does reflective thinking, will increase or decrease the effort he does based on their belief in his abilities. This can encourage students' creative thinking abilities in solving mathematical problems. Students who have low self efficacy are more likely to give up on academic activities compared to students with high self efficacy. The level of self efficacy of a student is influenced by his successes or failures in the past which will then have an impact on his success or failure in the future.

In his book "Self-Efficacy: The Exercise of Control", Bandura (1997) explains that one's self-efficacy will affect the actions, efforts, perseverance, flexibility in differences, and the realization of the goals, of these individuals, so that self-efficacy is related to a person's ability to often determine the outcome before the action occurs. According to Bandura, Self-efficacy, which is a central construction in social cognitive theory, which one has, will:

1. Influence his decision making, and influence the actions he will take. Someone tends to do something if he feels competent and confident, and will avoid it if not.
2. Help how far he tries to go in an activity, how long he survives if he gets into trouble, and how flexible in a situation that is less favorable to him. The greater one's self-efficacy, the greater the effort, perseverance, and flexibility.
3. Influence his mindset and emotional reaction. Someone with low self-efficacy easily gives up in dealing with problems, tends to be stressed, depressed, and has a narrow vision of what is best for solving that problem. While high self-efficacy will help someone in creating a feeling of calm in the face of difficult problems or activities.

Learning can stimulate students to learn independently, be creative, and be more active in participating in learning activities. One learning strategy that is part of constructivism learning that can be used in mathematics learning that gives students the opportunity to have creative thinking skills and self efficacy by using Brain-Based Learning (BBL) assisted by Schoology so that the ability to think creatively in mathematics and students' self-efficacy can be shown and increase.

One learning model to anticipate the weaknesses of conventional learning models is to use the Brain Based Learning (BBL) approach model. The core of the Brain Based Learning Approach is that students play an active role in building their knowledge, the teacher acts as a facilitator and mediator of learning. The treatment applied in the Brain Based Learning Approach is that students can get maximum

teaching and learning outcomes according to what they have.

Brain Based Learning has some characteristics; Active, Innovative, Creative, and Enjoyable. This method always emphasizes the involvement of students in each learning process. Innovative means that every learning must provide something new, different and always attract students' interest. Creative means that each learner must encourage interest in students to produce something or be able to solve a problem using methods, techniques or ways mastered by students themselves obtained from the learning process.

One of the information technology-based learning media that can be used by teachers to encourage students to be more active and can encourage students to develop their creative thinking abilities and self-efficacy is the Learning Management System (LMS). LMS is a software application or web-based technology that is used to plan, implement, and assess certain learning processes (Sicat, 2015). Some of the LMSs are Moodle, Edmodo, Blackboard, Sumtotal, Skillsoft, Cornerstone, Desire2Learn, Schoology, NetDimensions, *Collaborize kelas*, Iteractyx, Docebo, Instructor, *Meridian Pengetahuan Sol*, Latitude Learning, *Sakal*, Eduneering, Mzinga, *Epsilen,* and Inquisiq r3. According to Nurlaili's research (2016) there is an increase in students' creative thinking abilities when using schoology-assisted learning models. Therefore, this study uses the help of LMS learning media in the form of schoology.

Schoology is a Web 2.0 that is quite popular in students and teachers. This is an online learning session, classroom management, and social networking platform that enhances learning through better communication, associations, increased access to curriculum and additional content (Luaran, 2012). Teachers find it easier to send assignments to mobile devices owned by students and teachers can monitor the progress of student learning online by using schoology.

Based on the description of these problems, the researcher will conduct research on "Mathematical Creative Thinking Ability and Student Self Efficacy Through Schoology-Assisted Brain-Based Learning".

Based on the description above, the formulation of the problem of this research is: (1) How is the quality of brain based learning assisted by schoology toward the ability to think creatively better and can achieve minimal completeness ?; (2) How are students' mathematical creative thinking abilities evaluated from self-efficacy?

In accordance with the formulation of the problem above, the purpose of this study is to find out: (1) The effectiveness of brain-based learning assisted by schoology; (2) The increase in students' creative thinking after using schoology-assisted brain based learning is better; (3) the achievement of students' creative thinking in terms of self efficacy that is taught using schoology-assisted brain based learning.

METHODS

The research method used is a mixed methods, a type of sequential explanatory, where the type of sequential explanatory is a research design that combines quantitative and qualitative research, the first stage of the research conducted is data collection and quantitative data analysis, then the second stage is data collection and qualitative data analysis, with the aim to strengthen the results of quantitative research conducted in the first stage.

The population in this study were students of eleventh grade of SMP PL Domenico Savio Semarang in the academic year of 2017/2018. The determination technique of quantitative research sample is purposive sampling technique, then obtained research samples were class IX H as an experimental class and class IX G as a control class. Experimental class by applying schoology-assisted brain-based learning model learning and control class by applying brain-based learning model without schoology-assisted learning.

Data collection techniques used were tests of creative thinking skills, self efficacy questionnaires, interviews, and documentation. Quantitative analysis techniques include the

average test of creative thinking ability, completeness test, average difference test, and difference test of proportions. Qualitative analysis techniques used triangulation. In this study, some students were taken as research subjects, those who have high, medium and low self efficacy. Research data sources were students who have passed thinking skills test, and interviews. Students were given a test of creative thinking at the beginning and at the end of learning. Completion or answers of students' creative thinking abilities tests were used as a reference for interviewing research subjects based on the classification of self efficacy.

RESULTS AND DISCUSSION

Average Test

This study includes first data on the ability of creative thinking (pre-test) and final data on the ability of creative thinking (post-test) obtained from students in the experimental class and the control class. The data was obtained from the description test item of mathematical creative thinking ability amounted to five questions.

The average test of creative thinking ability in the experimental class that is class IX H t_{value} = 9.03 compared to t_{table} with an error rate of 5% that is 1.69. Because $t_{value} > t_{table}$ so H_0 is rejected. This means that the average scores of students' creative thinking ability in the learning of BBL Model assisted by Schoology is more than 75.

Completion Proportion Test

Proportion test was conducted to determine the mastery of learning classically after obtaining BBL Model learning assisted by Schoology in the mathematical creative thinking ability.

Based on the standard normal list with $\alpha =$ 5% obtained $Z_{table} = 1.64$. From the calculations, it is obtained $Z_{value} = 2.57$. Because $Z_{value} > Z_{table}$ so H_0 is rejected. This means that the percentage of students who achieved a minimum completeness of 75 in the BBL Model learning class assisted by Schoology has exceeded 75%.

Average Difference Test

Based on the calculation results, the average value of students in the Schoology-assisted Brain Based Learning class is 87.18 and the average value of students in the Brain Based Learning class without Schoology-assisted is 82.47.

The testing criteria H_0 is rejected if $t_{value} > t_{(1-\alpha)(df)}$ where $t_{(1-\alpha)(df)}$ is obtained from the distribution list t with df = $(n_1 + n_2 - 2) = (34 + 34 - 2) = 66$ and probability $(1 - \alpha) = (1 - 0.05) = 0.95$ so it is obtained $t_{(0,05;62)} =$ 1.67. From the calculations it is obtained $t_{value} =$ 2.24. Because $t_{value} > t_{table}$ so H_0 is rejected, so the average of students' mathematical creative thinking ability in Schoology-assisted Brain Based Learning classes is more than the average of students' mathematical creative thinking ability in Brain-Based learning classes without Schoology-assisted learning.

Proportion Difference Test

Proportional difference test was used to compare the proportion of students 'mathematical creative thinking completeness in the Schoology-assisted Brain Based Learning class with the proportion of students' mathematical creative thinking completeness in the Brain-Based learning class without Schoology-assisted learning. The number of students who achieved individual completeness in Schoology-assisted Brain Based Learning classes was 32, and the number of students who achieved individual completeness in Brain Based Learning classes without Schoology-assisted learning was 25 students.

The test criteria H_0 is rejected if $Z_{value} > Z_{(1-\propto)}$ is obtained from the standard normal distribution list with a chance $(1-\propto) = (1 - 0.05) = 0.95$ so that $Z_{(0,95)} = 1.68$. From the calculations it is obtained $Z_{value} = 2.31$. Because $Z_{value} > Z_{table}$ so H_0 is rejected. It means that the proportion of students' mathematical creative thinking completeness in the learning of Brain Based Learning assisted by Schoology is more than the proportion of students completeness in the learning of Brain Based Learning without the assistance of Schoology.

Student's Mathematics Self Efficacy

Students' self-efficacy of Class IX H is categorized into high, medium, and low level. Based on the results of the analysis conducted, data obtained indicate an increase in self-efficacy in students. In data analysis, researchers used the normalized gain value (N-gain), between the values before and after treatment, calculated using the following equation (Hake, 1998):

$$N - Gain = \frac{S_X - S_Y}{S_{max} - S_Y}$$

Information :
S_X = The observation score of the final meeting,
S_Y = Observation score of the first meeting
S_{max} = The maximum score a student might get

With the criteria for *N-Gain* value according to Archambault as quoted by Patih (2012) is as in Table 1.

Table 1. The Criteria of Normalized Gain (N-Gain) increased self-efficacy

Obtaining N-Gain	Criteria
N-Gain > 0.70	High
0.30 ≤ N-Gain ≤ 0.70	Medium
N-Gain < 0.30	Low

The N-Gain results showed that from 34 students in class IX H there were 2 students in the high self-efficacy category, 31 students in the moderate self-efficacy category, and 1 student in the low self-efficacy category. The results found by the researchers were then selected 2 students with high self-efficacy, 2 students with moderate self-efficacy, and 1 student with low self-efficacy because only 1 student had the value of self-efficacy in the low category.

Students' Mathematical Creative Thinking Ability in terms of the High Self-Efficacy Category

Students who have the creative thinking ability in the high category show satisfying results. Based on the information obtained from Figure 1 in Mathematical Creative Thinking Ability Test (TKBKM), the subject's answers are able to correctly and completely write down what is known and asked in the problem that occurred. It is also seen that the subject shows the elements and nets in the curved side geometry correctly. Figure 1 shows the results of high category student work.

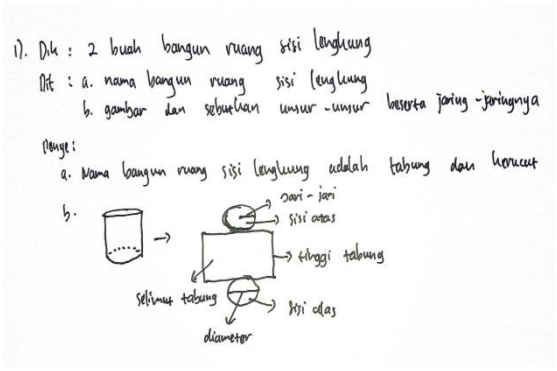

Figure 1. Students' TKBKM Results in terms of the High Self-Efficacy Category

Based on the results of interviews it is found that students with high problem solving skills can explain mathematical problems again, and are able to explain verbally what is the solution that the subject has done well. The subject also had a good idea in explaining the completion of the interview process that was done with the researchers.

Students' Creative Thinking Ability in terms of the Medium Self-Efficacy Category

Students who have the creative thinking ability observed from self-efficacy are showing good results. Based on information obtained from Figure 2, the subject's answers are able to formulate a solution to a mathematical problem to find the radius of the cone and the curved side of the cone, this proves that the subject is able to properly understand the problems that occur in mathematical problems. Figure 2 below lists the students' work in the medium category.

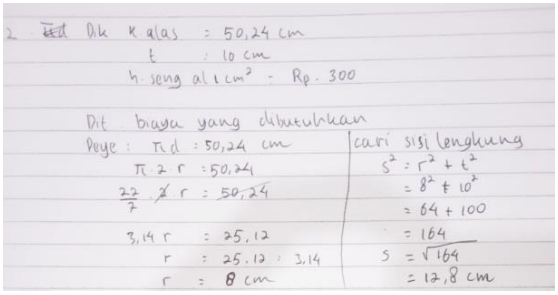

Figure 2. Students' TKBKM Results in terms of the Medium Self-Efficacy Category

Based on the results of the interview it was found that students with intermediate problem solving skills could explain the mathematical problem again and conclude the results of the work done but not the final answer in question in the mathematical problem that occurred.

Students' Creative Mathematical Thinking Ability in terms of the Low Self-Efficacy Category

Students who have the mathematical creative thinking ability observed from the low self-efficacy category show unsatisfying results. Based on the information obtained from Figure 3, the subject's answers are able to understand the problem well. The subject is able to explain what is the solution of the mathematical problems that occur, where the subject writes correctly the elements on the tube and cone, is also able to draw well the two curved side geometry, but the subject is not able to solve the problems that occur well, where the subject does not explain what is asked and known about the problem, nor is the subject able to formulate conclusions from the results of the answers the subject gives. Figure 3 below lists the students' work in the medium category.

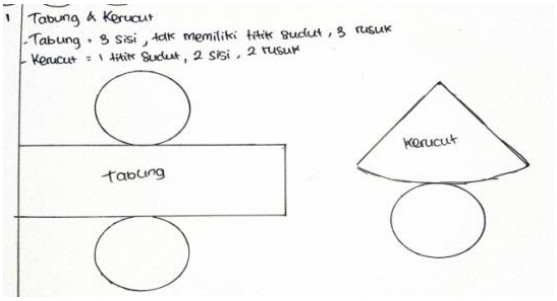

Figure 3. Students' TKBKM Results in terms of the Low Self-Efficacy Category

Based on the results of interviews it is found that students with creative thinking skills observed from the low self-efficacy category lack understanding when explaining mathematical problems and inferring the results of work done but did not explain how he did when calculating.

CONCLUSION

Based on the results and discussion of the research, it was concluded that the students' mathematical creative thinking ability in class using brain based learning assisted by schoology achieve completeness learning. The students' mathematical creative thinking ability in classes using brain-based learning based on schoology is better than classes that use brain-based learning without schoology-assisted learning. Students with the mathematical creative thinking ability observed from high self-efficacy category are able to solve and provide ideas on the problems given in a way that is interestingly clear. Students with mathematical creative thinking ability observed from medium self-efficacy category are able to formulate solutions with clear sentences and their own language to explain the problems and solutions given clearly. Students with the mathematical creative thinking ability observed from low self-efficacy category lack giving explanations and ideas and other interesting ways to answer accurately the problems given in the test of creative thinking ability.

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