Application Of Brain Based Learning (BBL) Models Based On Saintific Approach With 3D Cabries In Geometry Material To Increase The Ability Of Mathematics Communications For Students Of SMAN 1 Karang Baru

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***Abstract*— The aim of this study is to know the improvement of learning by using Brain-Based Learning (BBL) model based on scientific approach with Cabri 3D againts student's mathematical communication ability. This research is an experimental Quasi Experimental with Design Nonequivalent Control Group Design, which is research subjects were not randomly grouped with the provision of preliminary and final tests. The population of this research is all students of class X SMA Negeri 1 Karang Baru, Aceh Tamiang. Two classes were selected as research samples, namely experimental class and control class. The instrument in this research is a test of Mathematical Communication Skill. The research data was analyzed by using T test. The result of this research indicates that learning by using Brain-Based Learning (BBL) model based on scientific approach with 3D Cabri is better than using scientific learning for improving mathematical communication ability for students.**

Keywords: Brain-Based Learning Model, scientific approach, mathematical communication ability.

PRELIMINARY

Quality of life is determined by education, this is according to the important role to create human resources with good quality.) said the goal of education to create a faithful, pious, ethical, reasoned person, capable of social communication to be an independent human being. To achieve that goal one must has abilities, one of them is the ability of mathematics, especially the ability of mathematical communication, communication skills is an important aspect to be developed. This is because communication can help students learn mathematical concepts when they portraying situations, drawing, using objects, giving reports and giving verbal explanations. This is based on statements (Schoen, in Abdullah, 2013) Mathematical communication is the ability of students in terms of speaking, reading, explaining, describing, listening, asking, and working together.

According to Kimberly and Oshkos (2008) through mathematical communication students can organize mathematical thinking both orally and writing. Mathematic teachers in high school orchestrated classroom discourse with an emphasis on the importance of students' mathematical communication, both verbal and written as they engaged in problem solving, reasoning and proofs and how this influenced their thinking (Pourdavood, 2015).Students can also give respond to the using of media appropriately. Although communication skills are important, the reality in the communication skills is still low, this is equal to the research Rohaeti (2003) says that the average student KKM is in a less than once qualifying in communicating mathematical ideas.

Students still think that mathematics is a difficult and tedious lesson. This is because in learning mathematics students are required to calculation, reason and analysis. This form of learning activity activates the role of the left brain only. This means the ability of the brain has not been optimized because of the right brain function has not been fully active. Though the ability of the left brain only remember or keep the memory of a short-term while the right brain has long-term memory. Therefore, if only the left brain is dominant then there is a possibility of students are easy to forget the absorbed lesson. For forgetting, it certainly makes it difficult for students to solve problems.

The tendency of using the left brain can be seen the phenomenon that most often occurs in learning is concerned with what is learned (what to learn), not how to learn (how to learn). Therefore, it takes learning that can make students' brain potential to develop optimally. Brain-Based Learning (BBL) is a learning mathematics-oriented effort to empower students' brain potential. Brain-Based Learning instructional strategy is a learner-centered and teacher-facilitated strategy that utilizes learners' cognitive endowments. This instructional strategy is based on the structure and functions of the brain in different aspects such as learning, assimilating, thinking and remembering (Uzezi, 2017). BBL learning is appropriate to develop mathematical communication skills. This is because the learning is integrated into an emotional, social, cognitive, physical and reflective learning system. If the teacher understands how the primary learning system (emotional, social, cognitive,

physical, reflective) works, then teaching will be more effective and experience greater .

In order for the application of Brain-Based Learning (BBL) model to run more optimal, it takes a learning approach that supports the learning process is running well. The approach referred to this study is the scientific approach. Atsnan and Gazali (2013) stated the application of a scientific approach suitable for learning mathematics. According to the Directorate of the Ministry of Curriculum 2013 (Majid, A. 2013: 95) The scientific approach is intended to provide an understanding for students, understanding the material using a scientific approach, that information can come from anywhere, anytime, regardless of teachers . Therefore, learning conditions on the scientific approach that is expected created and directed learners in finding out from various sources or activities and not just be told, is expected with the activity during the learning process, the mathematics will be more meaningful and mathematics education for Indonesia to be better, Atsnan and Gazali (2013). From the explanation, the learning model of Brain-Based Learning (BBL) in accordance with the scientific approach is to create independent learners or not to make learners as recipients who only in the tell.

The high competence in the school curriculum, obviously can not be overcame by simply indicating conventional methods or approaches. To achieve the ability of mathematical competence, it is necessary select mathematical materials based on the scientific structure, the depth of material, the material characteristics, and the application. The applied approach must be able to optimize the students' learning motivation, make the students trained to study independently, streamline student learning process, and able to keep up with the rapid development of science and technology.

The use of computer software for learning activities is very unlimited (Fey and Heid, 1984: 21), and the potential of computer technology as a medium in mathematics learning is so great (Fletcher, 1983: 1). At this time already many special software that can also be used as a virtual tool in learning mathematics. Besides can be installed directly in some computer can also be DOWNLOAD from internet for use at OFFLINE. Some software that can be categorized as virtual props include; Cabri3D, Geogebra, Wingeom and Sketchpad geometers specifically designed for geometry learning.

With the software students can perform various manipulations of geometry objects as real props even more effective because to manipulate simply using MOUSE without having to involve fixtures such as rulers, runs, scissors, bows and folding activities, drawing so that time is used much more efficiently .

Cabri 3D is a computer system (software) for mathematics and physics, especially in geometry material. This program has been widely used among learners and educators. Cabri 3D has the facility to visualize functions or mathematical equations, by depicting the graphs for two dimensions and three dimensions. The advantages of using Cabri 3D software has a command of extensive mathematical workmanship, has good workmanship facilities in dimensions two and three dimensions, the programming language facilitate understanding the concept of learners, and also the results of better workmanship. The application of Brain-Based Learning (BBL) based on scientific approach which is collaborated with Cabri 3D software is expected to improve students' mathematical ability, one of them is mathematical communication ability.

From the above explanation, the authors are encouraged to conduct research entitled: "Application of Brain Based Learning Model (BBL) Based on Scientific Approach with 3D Cabri to improve Mathematical Communication skill in geometry material".

RESEARCH METHODS

The research used Quasi Experimental research with the design form of Non-equivalent Control Group Design, in which the research subjects are not grouped randomly. The first step in determining the experimental units is by selecting the school, then selecting two classes in terms of academic ability, where the two classes have equal ability.

The population in this research is all students of class X SMAN 1 Karang Baru in Aceh Tamiang academic year 2016/2017. The samples of the study were determined using purposive sampling which is a sampling technique based on certain considerations (Sugiyono, 2013: 126), then Sundayana, R (2010: 29) also stated that purposive sampling is used when sample members are selected specifically based on research objectives. The sample in this research is class XB and XC. From the two classes then randomly selected class for experimental groups and class for the control group. Both selected class XB as control group and XC class as experiment group have up to 20 students. the instrument of the research has been done in every school test in carefully and feasible to use. in the form of validity, reliability, differentiation, and instrument difficulty.

DATA COLLECTING METHOD

Data communication skills are collected through pretest and postest. Pretest was administered in both sample classes before being treated, whereas postest were administered in both sample classes after treatment was administered.

DATA ANALYSIS TECHNIQUE

Communication test results are used to examine the improvement of students' communication skills learned through the BBL Model Based on Scientific Approach with 3D Cabri. Data obtained from test results mathematical communication ability is processed Data obtained from the results of pretes and postes processed with the help of Microsoft Excell 2010 and IBM SPSS 20 software. Through the following stages:

1) Provide score of student answers in accordance with the key answers and scoring guidelines used.
2) Create a table of pretest and postes scores of students of the experimental class and control class.
3) Determine score of communication ability improvement with normalized gain formula (Meltzer, 2002), namely:

$$\text{Normalized gain} = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum possible score} - \text{pretest score}}$$

4). Conducting normality test to know normality of data of pretest score, postes and n-gain of mathematical communication ability using Kolmogorov-Smirnov statistic test. If the result of data analysis of preview score is not a normal distribution, hence can be tested research hypothesis with nonparametric test Mann Whitney U.
5) Test homogeneity of variance of pretest, postes and n-gain score of communication skill using Levene test.
6) Differential Flow Test
   For abnormal pretest scores using the Mann Whitney U, postes and N-Gain tests of communication capabilities that satisfy the normality and homogeneity requirements, can use the difference test with t-test (Independent Sample T-Test).

RESEARCH RESULT AND DISCUSSION

Mathematical communication skills data include pretest score, postes score, and N-Gain. The result of the pretest score is used to know the student's ability before the learning, the result of the postes score is used to know the students ability after the learning. While N-Gain data is used to see the improvement of students' mathematical communication ability after learning. The lesson in question is the Brain Based Learning model based on the Scientific approach with the 3D Cabri for experimental class and students in the classroom learning with the scientific approach for the control class. The following is a description of the pretest score, postes score and N-Gain students' mathematical communication abilities in the experimental class and control class for SMAN 1 Karang Baru.

Table 1
Description of Statistics of Mathematical Communication Skills

Name of School	Value	Experiment					Control				
		N	X_{min}	X_{maks}	$\bar{x}$	SD	N	X_{min}	X_{maks}	$\bar{x}$	SD
SMAN 1 Karang Baru	Pre tes	20	6,25	37,50	21,87	7,98	20	12,50	50,00	33,75	11,54
	Pos tes	20	50,00	87,50	68,12	9,91	20	31,25	62,50	49,68	10,62
	N-Gain	20	0,40	0,83	0,59	0,12	20	-0,11	0,45	0,23	0,14
Maximum Score Ideal = 100											

Table 1, the pretest score in the experimental and control classes in each school shows that between the two classes did not show any significant difference. It appears that the initial ability of the experimental class and control class students is not much different before acquiring learning of Brain Based Learning model based on Scientific approach with 3D Cabri and learning with scientific approach.

Based on the above data, the average difference test was performed to determine the average difference of pretest mathematical communication ability of the experimental class and control class. With the research hypothesis is "There is no difference in the value of pretest mathematical communication ability of students who study with Brain Based Learning model based on Scientific approach and students who learn by scientific approach". Mann-Whitney test results showed that there was no significant difference in mean score of pretest mathematical communication ability between experiment class and control class. The similarity of pretest score of mathematical communication ability of the students of both classes shows that there is no significant difference of mathematical communication ability between students in the experimental class and control class.

Furthermore, based on the results of Postes data analysis shows there is a significant difference mean pretest score of mathematical communication ability between experimental class and control class. The similarity of pretest score of mathematical communication ability of the students of both classes shows that there is a significant difference of mathematical communication ability between students in the experimental class and control class.

The final stage is done N-Gain score analysis of students 'mathematical communication ability using normalized gain data which aims to know the improvement of students' mathematical communication ability after being given good treatment in experiment class and control class. There are many statistical tests that have been invented by experts, therefore to determine the appropriate statistical test firstly tested normality.

a. Test Normality Data N-gain Score

Normality test is done to see whether the data obtained is normally distributed or not. Normality test is a determinant

requirement in the selection of parametric statistical tests or non parametric statistical tests.
The hypothesis formula for testing data normality is:
H_0: The sample comes from a normally distributed population
H_1: The sample is from an abnormally distributed sample

Normality test Gain mathematical communication ability in this study using statistical test Shapiro-Wilk at significant level α = 0.05. The normality test is performed using SPSS 21 software with the test criteria is if the value of Sig (P-value) ≥ α (α = 0,05), then H0 is accepted and if the value of Sig. (P-value) <α (α = 0.05), then H0 is rejected. The N-gain normality test results are presented in the following table.

Table 2
Normality Result of N-Gain Mathematical Communication Skill

Name of School	Result	Class	*Shapiro-Wilk*			Conclusion
			Statistic	*Df*	*Sig.*	
SMAN 1 Karang Baru	<g>	Experiment	0,974	20	0,833	Data is normally distributed
		Control	0,952	20	0,402	Data is normally distributed

Based on Table 2 shows that the value of Sig. N-gain mathematical communication ability of experimental class students in Shapiro-Wilk test is more than 0.05 then H_0 is accepted, it means pretest score of mathematical communication ability in experiment class with normal distribution. Next will be tested homogeneity

b. Homogeneity Test of N-Gain Score Data

The homogeneity test was conducted to test the homogeneity of experimental class variance and control class from N-Gain data of students' mathematical communication ability. The homogeneity test of postes score was calculated by Homogenity of Variances (Levene Statistic) test at significance level α = 0,05. The homogeneity test was performed using SPSS 21 with the test criterion is reject H0 if Sig. (P-value) <0.05, for other conditions H0 is accepted. Output of SPSS 21 on Test of Homogeneity of Variance postes score of students' mathematical communication ability in class that learn by Brain Based Learning based on Scientific approach and students in learning class with scientific approach can be seen in following table:

Table 3
Homogenity Test of N-Gain Variance of Mathematical Communication Skill

School	Result	*Levene Statistic*	*Df_1*	*Df_2*	*Sig.*	Conclusion
SMAN 1 Karang Baru	<g>	0,685	1	38	0,413	Homogenous Variants

Based on Table 3 for SMAN 1 Karang Baru shows the significance value of both the experimental class and the control class is greater than α = 0.05 ie 0.413, thus H_0 is accepted, meaning that the experimental class postes class score and the control class of students' mathematical communication abilities are from the population homogeneous. Based on that, it will be continued with 2 Independent Sample.

c. Test of Mean Difference N-Gain Mathematical Communication Skill

An N-gain difference test was performed to test whether there were significant N-Gain differences between students in the learning class with Brain Based Learning based on the Scientific approach with 3D Cables and students in the learning class with the scientific approach of the N-Gain data of students' mathematical communication skills.

Here's the statistical hypothesis:
H0: μ_pe = μ_pk
H1: μ_pe ≠ μ_pk

Information :
μ_pe = Pretest grade of mathematical communication ability of students whose study with Brain Based Learning model with scientific approach.
μ_pk = The mean value of pretest mathematical communication ability of students learning with scientific learning.
If the value of Sig. (P-value) ≥ α (α = 0.05), then H_0 is accepted and if the value of Sig. (P-value) <α (α = 0,05), then H_0 is rejected. The summary results are presented in the following table.

Table 4
Test Results Difference of Postes data Mathematical Communication Skill

SMAN 1 Karang Baru	*t-test for Equality of Mean*			*Conclusion*	*Information*
	T	*Df*	*Sig.(2-tailed)*		
	8,408	38	0,000	H_0 is rejected	Has difference

Based on the t test in Table 4, we get the sig value. (2-tailed) is 0,000 and shows smaller than 0.05 so that H_0 is rejected, it can be concluded there is a significant difference between N-gain data of mathematical communication ability of students learning in Brain Based Learning classroom based on Scientific approach and students studying in learning class with a saintic approach.

DISCUSSION

1. Mathematical Learning with Brain Based Learning Model Based on Scientific Approach With 3D Cabri

The results of the research that has been stated above shows that the mathematical communication ability of students who get BBL-based learning model of scientific approach with 3D Cabri is better than students who get ordinary learning with scientific approach only. The results of this study are reinforced by the findings of Yuda (2012) revealed the results of his research that there are significant differences in mathematics learning outcomes between groups of students who follow Brain-Based Learning model with groups of students who follow the conventional model in grade V students of SD Negeri in Sinabun village in second semester of 2012/2013 school year. Thus, Brain-Based Learning model has a positive effect on students' mathematics learning outcomes of grade V SD Negeri in Sinabun village. Ur-Rehman also stated that there was a positive influence on experimental class samples with Brain-Based Learning treatment compared with control classes.

If we consider the learning characteristics of the two models is a natural thing in difference. Theoretically learning with BBL-based learning model of scientific approach with Cabri 3D has several advantages when compared with scientific learning, which if these advantages are maximized in the implementation in the classroom enables the learning process to be better. These advantages can be seen through different views of learning characteristics, among others:

a. Teaching materials

Teaching materials, packaged in the context of contextual issues as presented in Student Activities Sheet (LAS). From the problems encapsulated in the LAS, students are encouraged to act actively in solving problems based on the procedures of the BBL-based learning model of a scientific approach with 3D Cabri, the circumstances or situations encountered and drawing conclusions through critical, logical and systematic scientific thinking processes. Students are given the opportunity for developing potential through a skill both in thinking, solving problems and finding. As Arends (2009: 43) BBL learning is designed to help students develop their thinking skills, problem-solving skills and intellectual skills and become self-reliant and autonomous learners

In the scientific learning model, teaching materials used textbooks that are used by teachers and learning activities are done by discussing examples of problems and continued with the exercise. This is one thing that makes the BBL learning model better in the learning process of mathematics than with ordinary scientific learning.

b. Teacher

By using the problem as context, the teacher's role in learning is authentic as a facilitator and organizer, which is to organize how students should learn and provide direction so that the material being studied is understood and interpreted by the students. Constraints faced by teachers in facilitating and accommodating students learning from problems are the heterogeneity of students' math skills in the classroom. Because the intelligence of students in the classroom is relatively varied, then the level of difficulty faced by students in solving problems also vary. Form of teacher intervention is done indirectly, that is by using scaffolding technique and clue. In scaffolding techniques teachers are required to be skilled at using questioning techniques, among which the most important is to break complex questions for students into more simple questions that are affordable to the minds of students at the time. Questions asked by the teacher in the form of directional questions.

In the ordinary scientific learning model, the teacher acts as a source of learning, explains concepts, explains examples of problems, gives practice questions that students must do according to the given example. The role of teachers in the learning process above leads to the recitation of concepts or procedures

c. Active Roles of Students

Brain-Based Learning (BBL) -based learning model with a scientific approach with 3D Cabri enables students to draw the spirit and activeness. Each student is given a worksheet or LAS that contains the problems. The focus of learning activities is entirely on the students are thinking of finding a solution of a problem and automatically activate physical and mental activities is a process to understand the concepts and procedures contained in mathematics problems. In this case, the problems faced by students have triggered cognitive conflicts.

In situations of cognitive conflict, students' cognitive abilities are fully utilized in seeking justification, confirmation and verification of their own opinions. Through this mental activity, the cognitive abilities of the students get the opportunity to be empowered, refreshed and strengthened if the student continues to work, he will try to exploit his memory, his understanding of mathematical concepts or his experience to end the conflict. This means the student has made maximum effort using all his cognitive abilities. In other words, it has reached its maximum level of actual development. The student's active role is enormous in learning.

On the contrary, in the ordinary scientific learning model, the student acts as a full recipient of information from teachers and students working individually during problem solving. The solution-resolution alternatives are heavily dependent on the teacher in solving the problem, so the nature of repetition imitates and memorizes as knowledge

formation with the teacher as a model and learning resource. Thus, the student's active role is very small in learning.

2. Student Mathematical Communication Skill

The ability of mathematical communication is one of the abilities that must be mastered by students. This study aims to determine whether the improvement of mathematical communication skills of students who study with Brain Based Learning Model Based on Scientific Approach With Cabri 3D is better than the ordinary learning with scientific approach only. Based on the data of the research results show the results of learning of students who are learning with Brain Based Learning Model Based on Scientific Approach With Cabri 3D has a better role in developing the ability of mathematical communication.

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