The Effects of Brain Based Learning Approach on Motivation and Students Achievement in Mathematics Learning

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Abstract. This classroom action research is based by the facts that the students motivation and achievement mathematics learning is less. One of the factors causing is learning that does not provide flexibility to students to empower the potential of the brain optimally. The aim of this research was to improve the student motivation and achievement in mathematics learning by implementing brain based learning approach. The subject of this research was student of grade XI in senior high school. The research consisted of two cycles. Data of student achievement from test, and the student motivation through questionnaire. Furthermore, the finding of this research showed the result of the analysis was the implementation of brain based learning approach can improve student’s achievement and motivation in mathematics learning.

1. Introduction
Based on observation carried out in the field, the students in mathematics learning are less motivated in following learning and methods are used still dominated by the use of conventional learning that lectures and their activities more centered on teachers. The activity of students just heard explanation teachers, noted examples and its discussion. In learning mathematics in class, students were not trust to find a solution in working, not able to optimize brain function, most smart students always get a chance to front of class, and less smart not trying over thought and given responsibility to settle a matter. Based on fact on problems in research is motivation students in learning mathematics is low, this can be seen from a lot of students not seriously in following learning and the majority of students have in trying to say about teachers give an individual good or group and this amount of math in learning is low, this can be seen from the test results daily students. Brain based learning is learning that aligned with the workings of the brain and designed naturally to learn [2]. Brain based learning is learning approach based on principles derived from an understanding of the brain [3]. There are some principle design learning based brain that learning based the brain offers a concept to create learning which oriented to empowerment efforts student’s brain [4]. According to Jensen the planning of brain based learning is: (1) the pre exposure; (2) the preparation; (3) initiation and acquisitions; (4) elaboration; (5) incubation and encoding memory; (6) verification and checking of trust; (7) celebration and integration. According to Rose “You have to be in a state of mind rich sense. It means you have to relax, confident, and motivated. If you stress or lack of confidence, so you can not are doing well” [5].

The study results done by educator to get a successes and feats of learning. The study results assessment is: described the extent to which students has mastered a competence, evaluate study results
students to help make the decision to the next step, find a learning disability, found the weak and lack of learning to repair learning next [6]. Study results of the students meaning is the motivation quite gives support in students to maintain even more improve their performance learned [7]. According to Soemarmo, and H. Hendriana said “study results of students is an integral part being inseparable in a learning” [8]. Based on opinion it can be concluded that is the study results success or achievement students in studying the subject matter at school, so that is a massive skills, habitual attitude and student’s knowledge. The implementation of brain based learning approach in mathematics learning based learning, made students trained implement learning based on seven the learning by brain based learning approach, order to be able to maximize the development of their brain for learning, which led to improve achievement mathematics learning. All kinds of learning involving memory including mathematics. If we can’t remember anything about mathematics experience, we are not going to get something [9]. Expert psychology know the importance of made two distinction of association regarding memory. The first, about three rounds of memory, include a message to memory (encoding), storage (storage), and recall (retrieval). The brain in the human body is an amazing device, and the number of cells in the brain is an important factor in the unfolding of intelligence [10].

Based on the exposure, it was believed that brain based learning able to improve motivation and learned mathematics student achievement. For it, should be designed brain based learning approach. Later, the result can be used by sharing parties. For students, with an implement brain based learning, student gets learning experience based on the workings of the brain, so students can improve mathematics and motivated to understand the mathematics. Next, students can make maximum use of his brain in learning. For mathematics teachers, this research can be used as one alternative in an election approach learning to improve motivation and mathematics student achievement. This has evidenced by research conducted Lestari [11] and Nurhadyani [12] concluded that the overall the motivation to study students who obtained through learning math based learning the brain, demonstrate the attitude of positive. The research by Kusmariyanti [13] and Ambar [14] also increased study results students with brain based learning approach. Using brain based learning approach, teachers can make studying to become more meaningful, optimizing brain development students, and enable student discussions. According to Bahri discussion method is "the manner of presentation of lessons, where the students are exposed to a problem can be a question or questioning which is to problematical to be solved together. For schools, this research can be considered in the development of mathematics learning approach, and this is expected to develope in learning the other studies. For researcher, this research can provide experience directly to the researchers as educators in applying brain based learning approach.

2. Research Method

The subject research is the student class XI IPA in SMAN 1 Kampar Kiri Hulu, the number of students 25 people students consisting of 5 men and 20 women. The object research is the brain based learning approach, student’s motivation and achievement in mathematics learning. This research the class discuss about the probability. The research phase class action concerning with cycle [15]. This research was done in two cycles. Many cycle consisting of four the stage: (1) planning; (2) action; (3) observation/evaluation; and (4) reflection [16]. The first cycle talked about the multiplication, the permutations, and combination in problems solving. The second cycle talked about determine the opportunity to an event and interpretation. Research planning covering: (1) learning observation on class XI SMA; (2) the problem analysis that is authentic found in observation; (3) planning application of the brain based learning approach to solve the problem; (4) socialize to other teachers as an observer involved in research about brain based learning approach and assessments technique necessary; (5) composing grains instruments; and (6) plan to collect data technique.

The action performed with stages as follows. Beginning with learning to socialize approach matter opportunities to students, brain based learning approach, stated that learning implemented in groups, then implement learning with stages: 1) pre-exposure, at this stage given an overview of new learning before
dig deeper in learning. The division of worksheet; 2) preparation, the teacher explain the material of lesson and connect it with everyday life and division of a group and early explanation linked to the real world; 3) Initiation and acquisitions is the creation of a connection between neuron-neuron of the brain, one of core explanation with the project on group; 4) elaboration is stage to give opportunity to the brain to sort, investigate, analyze, test, elaborating lessons, discuss in group; 5) incubation and enter memory, emphasize that rest time and repeat again is important, games and relaxation; 6) verification and checking confidence, is the stage to know whether students have understand about the material lesson, test by question among students and ending with written test; 7) celebration and integration, instill all the importance of passion for learning. Awards and celebrate success. The students fill the survey motivation in the end of pieces worksheet.

The stages of observation/evaluation is as follows: (1) observe and evaluate the process or student’s activity during use brain based learning approach; (2) evaluate student’s achievement with a lesson test; (3) evaluate student’s motivation on the learning program with the survey; (4) evaluate obstacles during the action. Doing reflection at the end of each learning and the end of cycle. As the basic of reflection is the survey, test result, sheet observation and interview to students about their difficulty during they follow the learning. The result of the first cycle reflection is used as a basic for the planning and carrying on second cycle.

In this research is used two kind of instrument, are the result of learning test to take the student’s mathematical learning achievements and survey to see student’s motivation about brain based learning approach. The data of learning achievements are analyzed with descriptive statistic to determine the value of the average student’s learning achievement, absorption capacity (DS), classical completeness (KK), and percentage of the learning achievement. The learning achievement to be completed, when get value is \( X \geq 65 \). This is correspond with the KKM which is set by school. This research can be said successful if \( \bar{X} \geq 65 \) and DS \( \geq 65 \) % and KK \( \geq 85 \) %. The data about the student’s motivation to mathematics learning by brain based learning approach are analyzed with descriptive and the conclusion based on the student’s answer in the survey. The criteria for the success of action when student’s motivation is positive.

The data in this research is analyzed use analysis data quantitative model, and supported by qualitative data. According to Creswell quantitative data is data of numbers and are analyzed based on a statistical procedure [17]. Qualitative data is the analysis of data since collect data to all data are collected [18]. The data is reduced based on the problem which is on over and over again at every stage of collect data in every action. Quantitative data is obtained from the result of written test in every cycle, then from the student’s value is conclude the student’s completeness compared with the value before. Qualitative data to look the level of student’s motivation through the open survey.

3. Result and Discussion

3.1 Result

The result of analysis of student’s value after an action on first cycle showed that variant relatively high. On a scale 100, the scores of learning result from 40 to 85. The average of value, \( M = 64.8 \), absorption capacity DS = 64.8 % (enough category ) with the criteria not yet complete. Completeness determined in accordance with the KKM is 65%. Classical completeness, KK= 68 % with the criteria not yet complete under KK is minimum 85%. Standard deviation, \( SB = 12.20 \). From 25 students who joined the test revealed to scatter scores of learning result on each category are very less category (0-39,9) as many as 0%, less (40-54,9) as many as 20%, quite(55-69,9%) as many as 12%, good (70-84,9) as many as 60%, and excellent (85-100) as many as 8%.

The result of analysis of student’s value after action in the second cycle showed that variant relatively lower than variant in the result of learning on the first cycle. On a scale 100, the scores of learning result from 60 up to 100. The average M = 75 (good category), absorption capacity DS = 75% (categorized good) with criteria is completed, classical completeness, KK= 88% with criteria is completed, and
standard deviation SB=10.10. From 25 students who joined the test revealed to scatter scores of learning result on each category are very less category (0-39.9) as many as 0%, less (40-54.9) as many as 0%, quite (55-69.9%) as many as 8%, good (70-84.9) as many as 72%, and excellent (85-100) as many as 20%.

The results of analysis of motivation from the student’s answers in the open survey about brain based learning approach at the end of each cycle is the first cycle there were some students who not yet have motivated in mathematics learning and on the second cycle has increase motivation to a positive direction.

3.2 Discussion

The results of research showed that increased on the student’s result learning. On the first cycle got the value of the average of result learning is 64.8 (enough category) and on the second cycle is 75 (good category). Increased the student’s average of the result learning from the first cycle to second cycle is 15.74%. This result of research indicate that brain based learning approach can be applied to improve students learning outcomes.

On the first cycle, the result of learning has not yet complete, caused by several factors, are: students not motivated in mathematics learning. This look there were several groups which less active in discussion and give question. Seventh phase in brain based learning less realized, so that, the students could not maximize their brain functions. When integration between students and between groups, some students still unable to submit questions and answers well, this is because the time very limited. So that students are hurry in filling worksheet, and students are not used to do this.

Related to the unfinished achievement of learning outcomes in the first cycle, then did actions to improvement on the implementation of learning the second cycle, so that achievement of results improvement efforts of the second cycle becomes more optimal. The information performed are as follows: associated with unmotivated students in mathematics learning gives the students a telling that who are active in group, asking will get a plus (additional). Associated with there are several groups that are active then the teacher to form new based on previous learning outcomes, so that each group there are students who have various ability. Associated with the implementation of the brain based learning approach, at phase 3 the teacher do learning which attract as using media learning through the slides how. When question and answer is given the opportunity to discuss first in the group before asking question and answering from the group and teacher provides more intensive guidance on students in solving problems within the group.

The result of students motivation analysis showed that students of grade XI SMAN 1 Kampar Kiri Hulu have positive motivation toward the implementation of brain based learning approach. Based on the results, generally it appears that students are able to adapt to the application of brain based learning approach. Through this learning approach, students motivation to learn can be grown. Brain based learning approach basically emphasizes the learning process that provides learning experience by getting new knowledge or concepts from the student’s experience.

The result of this research support the theory and results of the previous research. Based on the information processing theory, students learn brain using the ability to receive and use information and rewrite in accordance with cognitive [19]. Duman in his research revealed that brain based learning do not just to increase the student’s result of learning, but also build student’s motivation and teacher get better, improve the result of student’s works, and increase student’s interest learning [20]. Research conducted relevant by Lestari concluded that the overall the motivation to study students who were eligible mathematical learning with the brain based learning demonstrate the attitude of positive. Learning process by brain based learning approach, train the students to connect material learning with real life and then by excavation early student’s knowledge as an attempt to find information the extent to which the material a prerequisite have understood by students. Based on the early student’s knowledge, the teacher facilitate students to review the problem, and followed learning process. After the students have the motivation to study and wishing to control a particular concept, then given the opportunity to undergo be alone what will be studied through the activity in the group. Then, students are given the opportunity to ask and give
the answer from what they had learned. Research by Kusmariyatni concluded that the implementation of the brain based learning can improve learning outcomes students. The study results rata-rata students at cycle 1 was 64.81 ( enough category ) and on cycle 2 to achieve 79.89 (good category). Increase from the cycle 1 to cycle 2 of 23.26 %. A number of problems or deficiency were mentioned during learning is: (1) teachers difficult to guide evenly to students despite the limited prep time; (2) some students are not used implement lab work , active ask , pass an opinion , and discuss with her classmates; and (3) some items rather difficult to be context .Based on it requiring teachers to more creative find context in daily life which relevant to the matter of the study.

Based on the exposure and the reflections implemented, the successful implementation of brain based learning approach caused by this approach has many advantages among other: (1) the application of brain based learning approach, the students is involved in the activities of learning so that the process of learning is fun, this causes students to be motivated to learn; (2) the teacher role as facilitator and mediator in classroom learning, so the students are optimal in developing the brain function; (3) implementation brain based learning approach provide opportunity for teachers to carry out objective assessment of the students through observation; (4) brain based learning approach the brain provides opportunity for students to learn according to what the students want by extracting the experience possessed by the students and making use this experience as preliminary information to carry out further learning, 5) Implementation of brain based learning approach can teach students to be more active and able to reflect the learning activities so that student’s minds are fully on the learning process that takes place 6) Through the implementation of brain based learning approach, learning activities become more focused and systematic and can focus student’s attention in learning, because supported by the worksheet, 7) Brain based learning approach provides opportunities to students to interact, both to the material , friends , and teachers.

Some of problems or deficiency were mentioned during used brain based learning approach are: (1) some items rather difficult to be context which is connected with real life, so that the teacher have to creative in connect the material to the real world; (2) the teacher difficult to guide the students because the time are limited; (3) some students are not yet used implement, active to ask, pass an opinion, and discuss with their classmates.

Based on the discussion, we can get the conclusion from the research is brain based learning approach can connect emotional system, cognitive, physical, social, and reflective students [21] The fifth system of learning affect each other and can’t stand alone. Appropriate approach used in mathematics learning in senior high school to improve the quality of student’s think and the quality of their experiences in the class, so students are motivated to learn and eventually increasing learning achievements.

4. Conclusion
The implementation of brain based learning approach can improve student’s achievement learning. The students stated that they are motivated with the implementation of brain based learning approach brain and are given contextual problems connected with the material of lesson which is learned. Based on research conclusion, be brought some suggestions as follows: the mathematics teachers in senior high school, are suggested to use brain based learning approach as one of the innovative learning in order to optimize student’s brain function, so that can increase the motivation and student’s learning achievements. The learning can be adjusted to characteristic of the school, class, and individual students. In applying brain based learning approach, the teacher should consider restriction of each groups, and the divide members of the group that students can active while discuss in their group.

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