The effect of brain based learning with contextual approach viewed from adversity quotient

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The effect of brain based learning with contextual approach viewed from adversity quotient

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Abstract. The aim of this research was to find out the effect of Brain Based Learning (BBL) with contextual approach viewed from adversity quotient (AQ) on mathematics achievement. BBL-contextual is the model to optimize the brain in the new concept learning and real life problem solving by making the good environment. Adversity Quotient is the ability to response and faces the problems. In addition, it is also about how to turn the difficulties into chances. This AQ classified into quitters, campers, and climbers. The research method used in this research was quasi experiment by using 2x3 factorial designs. The sample was chosen by using stratified cluster random sampling. The instruments were test and questionnaire for the data of AQ. The results showed that (1) BBL-contextual is better than direct learning on mathematics achievement, (2) there is no significant difference between each types of AQ on mathematics achievement, and (3) there is no interaction between learning model and AQ on mathematics achievement.

1. Introduction

Mathematics is about thinking, organizing, and also a logic proofing [1]. Students do a problem solving in mathematics learning. There are some issues in mathematics learning. The difficulty to understand the concept and solve some mathematics problem, teacher centered, and passive students are the issues that found in the implementation. Commonly, teacher gives the properties and formulas directly to the students in the geometry learning. Students have not experience in the solving contextual problem in geometry. Figure 1 shows the example of the contextual problem.

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A student would like to make a box. She prepares 12 x 8 cm two cardboards and the other two are 8 x 9 cm. How many types of cardboard that he needs to make the box? What is the size of cardboards?
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Figure 1. Contextual Problem of The 3D Net

Some students could not solve this problem easily. Basically, this problem is about the nets of the box. Students only remember the properties of the cuboid to find cardboards that they need. Then, they arrange the different cardboards to be a box. So, the active learning methods need in learning process to support and optimize the students’ ability in geometry.
The constructivism theory states that the students’ achievement is an active activity where students construct their knowledge and find the meaning of what they learnt [2]. The students construct their knowledge through some activity. Then, they conclude what they have learnt. Based on the definition of student’s achievement and mathematics, student's mathematics achievement in this research is a result of all active activities that have done during the mathematics learning process and also do an interaction with their social environment and mathematical objects.

Brain Based Learning (BBL) facilitates students to active and enjoy the learning. BBL is a learning that related to how our brain works naturally in the learning process [3]. The teacher’s roles are important. The teacher should motivate, support, and guide the students in the process. So, it builds the positive environment for the students.

Student is the main subject in learning process who does some activities to achieve the best achievement. One of the learning approaches is contextual approach. This approach facilitates the students to construct their knowledge. It involves students actively to solve the real problem. The students could share their idea through the group discussion. There are seven principles of contextual approach in the instruction. They are constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment [4].

The definition of BBL-contextual is the model to optimize the brain in the learning of new concept and the real life problem solving by making a good environment. The implementation of BBL-contextual model in the geometry learning, specifically in the learning of 3D nets, shows in Figure 2. Generally, there are seven steps of BBL-contextual model, such as pre-learning, preparation, initiation and acquisition, elaboration, incubation and formation of memory, verification, and integration [5].

![Figure 2. The Steps of BBL-Contextual Model](image)

In the second step (preparation), students get motivation about the application of the 3D nets in their life, such as the box, aquarium, etc. formed by the net of cuboid or cube. In the third step (initiation and acquisition), students bring the some boxes, and then they cut the box in many ways to
get the nets of the boxes. The net 1, net 2, net 3, etc. in Figure 3 are the nets of cube that students would get. In elaboration, students complete their worksheet by drawing the nets of the boxes that they got as shown in Figure 3.

Figure 3. Students’ worksheet of 3D net

In the learning process, there are many factors that influence students in their study. The factors could be come from external or internal. One of the factors is Adversity Quotient (AQ). AQ is the ability to response and face the problems, also how to turn the difficulties into chances. The types of AQ divided into three types. They are quitters, campers, and climbers [6]. Quitter is someone who is no effort or spirit to achieve their goal. Camper is someone who satisfies to the result that he got. Climber is someone who always thinks that every obstacle will not block their way to achieve their success.

The previous research about the effectiveness of BBL model shows that BBL was significantly positive in increasing the mathematics achievement [7,8]. Also, the previous research shows about AQ shows that AQ impacts the students in their learning [9]. Besides that, AQ also has a significant role in the learning process [10]. The learning process should be facilitating what the students need. The learning also should be more interactive and meaningful to helps students in the good achievement in geometry. BBL-contextual gives a chance for the different AQ of students by making a good condition for learning.

According to the issues, the study about BBL-contextual and AQ is essential to do to know the effect of this model, AQ, and also the interaction between the models and AQ on mathematics achievement.

2. Experimental Method
This research method was a quasi-experiment. The research design was 2x3 factorial designs as shown in Table 1. The experiment group was the group that use BBL-contextual model in the learning process. The control group was the group that use direct learning model in the learning process.

| Group    | Adversity Quotient (AQ) |
|----------|-------------------------|
|          | Quitters (b₁) | Campers (b₂) | Climbers (b₃) |
| Experiment (a₁) | a₁b₁ | a₁b₂ | a₁b₃ |
| Control (a₂)     | a₂b₁ | a₂b₂ | a₂b₃ |

where

- a₁b₁: mathematics achievement of quitters’ students by using BBL-contextual learning
- a₁b₂: mathematics achievement of campers’ students by using BBL-contextual learning
- a₁b₃: mathematics achievement of climbers’ students by using BBL-contextual learning
- a₂b₁: mathematics achievement of quitters’ students by using direct learning
- a₂b₂: mathematics achievement of campers’ students by using direct learning
- a₂b₃: mathematics achievement of climbers’ students by using direct learning
The population was the students of grade 8th of public junior high school. This research did in Surakarta. The sample was chosen by using stratified cluster random sampling. The sample was 109 students. The students divided into two groups; 49 students as the experiment group and 60 students as the control group.

The independent variables were the learning models and AQ. The dependent variable was student's mathematics achievement. The instruments were test and questionnaire for the data of AQ. The test and questionnaire were given to the two groups after the treatment. The test for mathematics' achievement was 25 items of multiple choice test. The test validated by the masters of mathematics education and the questionnaire of AQ validated by the masters of psychology. Then, the instruments tried out to the other 76 students who did not the subject of this research.

The normality and homogeneity test did before the data analysed. The data was analysed by using two ways ANOVA to know the interaction of two independent variables to the dependent variable. The hypothesis in this study were

2.1. $H_{0A}: \alpha_i = 0$, for every $i = 1, 2$

$H_{1A}$: at least one $\alpha_i$ was not zero

2.2. $H_{0B}: \beta_j = 0$, for every $j = 1, 2, 3$

$H_{1B}$: at least one $\beta_j$ was not zero

2.3. $H_{0AB}: (\alpha\beta)_{ij} = 0$, for every $i = 1, 2$ and $j = 1, 2, 3$

$H_{1AB}$: at least one $(\alpha\beta)_{ij}$ was not zero

where

$\alpha_i$ : the effect of row $i^{th}$ to dependent variable

$i = 1, 2$

1 = BBL-contextual model 
2 = direct learning model

$\beta_j$ : the effect of column $j^{th}$ to dependent variable

$j = 1, 2, 3$

1 = quitters
2 = campers
3 = climbers

$(\alpha\beta)_{ij}$: The interaction of row $i^{th}$ in column $j^{th}$ to the dependent variable

The level of significant is $\alpha = 0.01$. The criteria of $H_0$ is rejected if $F > F_{\text{table}}$ [10].

3. Result and Discussion

The data of the mean score of mathematics achievement shows in Table 2. The data is about the mean score of each AQ by using BBL-contextual or direct learning model. Table 2 shows that the mean score of mathematics achievement of each AQ in experiment group was higher than control group. The mean score of quitters, campers, and climbers students by using BBL-contextual were higher than the quitters, campers, and climbers’ students by using direct learning.

| Model               | AQ          | Mean Score |
|---------------------|-------------|------------|
|                     | Quitters    | Campers    | Climbers   |
| BBL-contextual      | 61.91       | 55.69      | 65.54      | 61.05     |
| Direct Learning     | 46.43       | 54.81      | 58.00      | 53.08     |
| Mean Score          | 54.17       | 55.25      | 61.77      |

Normality and homogeneity test did before the hypothesis testing. Normality test was done to know the data normally distributed or not. If the significant was less than 0.01 or $L_{\text{obs}} > L_{\text{table}}$, then $H_0$ is rejected. The result of normality test by using Lilliefors method shows in Table 3 and Table 4. The data that used in normality test was the data of mathematics achievement test of each group.
shows that the $L_{obs}$ score of mathematics achievement in experiment group was less than $L_{table} = 0.15$ and also $L_{obs}$ mathematics achievement in control group was less than $L_{table} = 0.13$. So the population normally distributed for both groups. Table 4 shows that the $L_{obs}$ score of mathematics achievement of quitters’ students was less than $L_{table} = 0.17$. Also, the $L_{obs}$ score of mathematics achievement of campers’ students was less than $L_{table} = 0.15$ and $L_{obs}$ mathematics achievement of climbers’ students was less than $L_{table} = 0.19$. So the population normally distributed for both groups. Then, it continued to the homogeneity test.

Table 3. Normality test of mathematics achievement in each group

| Group    | Normality Test (Lilliefors Method) | Conclusion |
|----------|-----------------------------------|------------|
|          | $L_{obs}$ | $L_{table}$ | Interpretation |
| Experiment | 0.09     | 0.15       | $H_0$ is not rejected | Normal |
| Control   | 0.10     | 0.13       | $H_0$ is not rejected | Normal |

Table 4. Normality test of mathematics achievement in each type of AQ

| AQ       | Normality Test (Lilliefors Method) | Conclusion |
|----------|-----------------------------------|------------|
|          | $L_{obs}$ | $L_{table}$ | Interpretation |
|          |          |          | $H_0$ is not rejected |
| Quitters | 0.12     | 0.17     | Normal         |
| Campers  | 0.10     | 0.15     | Normal         |
| Climbers | 0.13     | 0.19     | Normal         |

Homogeneity test used Bartlett testing by using chi-square test. Homogeneity test was done to know the classes had the same variance or not. If $\chi^2 > \chi^2_{table}$, then $H_0$ is rejected. The data of mathematics achievement test of each type of AQ was compared. The results were $\chi^2_{obs}$ of each group is less than $\chi^2_{table} = 9.21$. This result shows in Table 5. Table 5 shows that the variances of score of students’ mathematics achievement of quitters, campers, and climbers students in experiment group were homogen. Also, the variances of score of students’ mathematics achievement of quitters, campers, and climbers students in experiment group were homogen.

Table 5. Homogeneity test

| Group    | $\chi^2_{obs}$ | $\chi^2_{table}$ | Interpretation | Conclusion |
|----------|----------------|------------------|----------------|------------|
| Experiment | 0.30       | 9.21             | $H_0$ not rejected | Homogen    |
| Control   | 0.63       | 9.21             | $H_0$ not rejected | Homogen    |

The results by using two ways ANOVA shown that $F = 9.91 > F_{table} = 6.89$ as shown in Table 6. It concluded that there was significant different of learning by using BBL-contextual or direct learning on mathematics achievement. Table 6 also shows there was significant different between each type of AQ since $F = 3.20 < F_{table} = 4.82$. It means that there was no difference between quitters, campers, and climbers students on mathematics achievement. In the other hand, there was no interaction between learning model and AQ since $F = 3.08 < F_{table} = 4.82$.

Table 6. Two ways ANOVA

| Source     | JK  | dk | RK  | $F_{obs}$ | $F_{table}$ | Interpretation  |
|------------|-----|----|-----|-----------|-------------|-----------------|
| Model      | 1538.21 | 1  | 1538.21 | 9.91       | 6.89        | $H_0$ is rejected |
| AQ         | 992.79   | 2  | 496.40  | 3.20       | 4.82        | $H_0$ is rejected |
| Interaction| 957.02   | 2  | 478.51  | 3.08       | 4.82        | $H_0$ is not rejected |
| Error      | 15988.13 | 103 | 155.23  | 3.08       | 4.82        |                 |
| Total      | 19244.92 | 108 |         |            |             |                 |
As shown as Table 2, the mean score of experiment group by using BBL-contextual model is 61.05 which higher than the mean score of direct learning is 53.08. It means BBL-contextual model is better than direct learning model in mathematics instruction.

Based on the result, there is significant different between learning mathematics by using BBL-contextual and direct learning. BBL-contextual model facilitates the students to optimize their brain on mathematics learning. The students need a good or positive environment to study well. The motivation and support from the teacher are important for them. The learning process would be smooth if the students do well in their study. In the other hand, the teacher is only explain the material to the students. The students drill by solving many problems, but less contextual. The students get bored in the learning. They are only sit and hear the explanation. It would impact to their achievement if they are not focus in study. The research about BBL supported by the previous research that shows BBL was significant effect the students’ achievement [5,7,8]. BBL also gave the positive contribution to the achievement [12]. So, BBL is better than traditional method. Then, BBL-contextual is better than direct learning in the mathematics learning.

AQ is the ability to response and face the problems, also how to turn the difficulties into chances. Quitters have no effort or spirit to achieve their goal. So, the students that have the quitters type would be give up easily in the difficult problem. Camper is someone who satisfies to the result that he got. The students that have the type are unwilling to increase their level even though they have the ability to develop. Climber is someone who always thinks that everyone obstacle will not block their way to achieve their success. The students that have the type would be full of spirit to solve every problem on the difficult case. Besides that, there are also another factors, such as students’ intelligent that did not research in this study. If the climber that have a motivation to study and face the problem has the low intelligent, then they might not get the best achievement because the geometry problems need a good analysing. The intelligent or AQ only could not guarantee to get the high achievement, but the intelligent, AQ, and emotional related each other [13]. So, there is no difference between quitter, camper, and climber on mathematics achievement.

The result also shows that there is no interaction between learning model and AQ. The learning model implemented in the learning process to facilitate students to achieve the better achievement. For the each type of AQ, BBL-contextual as the active learning is better than direct learning in mathematics learning. In fact, there are also many factors that influence students in the process. Teacher, as a facilitator, could not always handle all of the factors. Students distracted by another factors during the learning process. So, the mathematics achievements of quitter, camper, and climber students were same for each learning models (BBL-contextual and direct learning).

4. Conclusion

According to the result, it concluded the learning by using BBL-contextual is better than direct learning. It was shown by the result of two way ANOVA with different cell testing that the score of $F = 9.91 > F_{table} = 6.89$. Also, the mean score of BBL-contextual group is higher than control group which learning by using direct learning. So, BBL-contextual could be implemented in geometry learning. The model facilitates the students to learn actively and effectively. It also concludes there was no different on the achievements of quitter, camper, and climber students. It was shown by the result of two way ANOVA testing that the score of $F = 3.20 < F_{table} = 4.82$. The research also concludes that there is no interaction between learning model and AQ. BBL-contextual supports the good condition for study and solving the contextual problem. The students learnt by their own way and they were not bored then participate actively in the discussion. The teacher also gives an attention to the students’ difficulty. So, the teacher knows their weakness and develop the learning media to minimize the students’ mistake in problem solving.

Finally, it would be better if mathematics’ teacher could implement BBL-contextual in geometry learning and develop this model with another learning model or learning approach to increase the student’s mathematics achievement. One more note, the students have different ability, intelligent, personality, etc. Therefore, in the further research, this factor could be attention. For other researcher, they could research about another variables or comparing BBL-contextual and the other learning model or approach.
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