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The Effect of PBL Model on Students' Critical Thinking Ability in View of Adversity Quotient (AQ)

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A B S T R A C T

This study aimed to examine the effect of the Problem Based Learning (PBL) model on the critical thinking skills of class XII students at SMAN 3 Tanjung Jabung Timur, as viewed from their Adversity Quotient (AQ). This research employed a quasi-experimental design with two groups: a control group that received conventional learning and an experimental group that received PBL. Data were collected through pretest scores, posttest scores, and an AQ questionnaire. Data analysis was performed using independent samples t-tests and Pearson correlation, with SPSS version 27. The results indicated a significant effect of the PBL model on enhancing students' critical thinking skills (p-value = 0.002; Cohen's d = -0.852). Students in the PBL group demonstrated higher critical thinking skills compared to those in the control group. However, there was no significant relationship between AQ and students' critical thinking skills (r = -0.166; p-value = 0.221). These findings suggest that the PBL model is effective in improving students' critical thinking skills, although AQ did not directly moderate this effect.

1. Introduction

Critical thinking skills are one of the important skills that students must have in the 21st century (Facione, 2013). However, the results of the Programme for International Student Assessment (PISA) show that the critical thinking skills of Indonesian students are still low (OECD, 2019). Therefore, an effective learning model is needed to improve students' critical thinking skills. One potential learning model is Problem Based Learning (PBL). Each student has a different response in solving a mathematical problem. Some students consider the mathematical problem as a challenge that must be faced and solved, while other students consider the mathematical problem they face to be a difficult problem so that they are unable to face it. The student's response in responding to a difficulty is called Adversity Quotient (AQ) (Stoltz; 2000).

PBL involves students in facing challenging and uncertain situations. This helps students develop resilience and resilience in the face of adversity, which are important components of AQ. In PBL, students are encouraged to take the initiative and take responsibility for their own learning. This helps to increase self-confidence and the ability to solve problems independently. Also, PBL is often done in groups, which allows students to learn to collaborate and support each other in facing challenges. These skills are very important for developing high AQ.

Based on this, the purpose of the study is to test the effect of the PBL model on students' critical thinking skills. To analyze the relationship between AQ and students' critical thinking skills. This study is expected to provide benefits for teachers in choosing an effective learning model to improve students' critical thinking skills. For students, this study is expected to improve their critical thinking skills. For schools, this study can provide information about the effectiveness of the PBL model. For further research, this study can be a basis for further research on PBL and critical thinking skills.

2. Methodology

This study used a quasi-experimental design with a posttest-only control group design. This design involves two groups, namely the control group and the experimental group. The subjects of the study were grade XII students at SMAN 3 Tanjung Jabung Timur consisting of 5 classes. The research sample consisted of 56 students divided into two groups, namely the control class of 28 students and the experimental class of 28 students.

The instruments used in this study were pretest data obtained from the value data from the prerequisite material that had been studied previously, posttest data, namely the results of the critical thinking ability test in the form of descriptive questions and the Adversity Quotient (AQ) questionnaire. The critical thinking ability test was used to measure students' critical thinking abilities after the control class and sample class were given different learning treatments. And the Adversity Quotient (AQ) questionnaire data was obtained after students in the control class and the experimental class filled out the questionnaire that had been prepared to measure the ability of individuals (students) to face and overcome difficulties or challenges in life.

This research was conducted in several stages, namely: (1) preparation, initial data collection, and determination of control and experimental classes, (2) implementation of learning (PBL for the experimental group, conventional learning for the control group), (3) giving critical thinking ability tests, (4) filling out the AQ questionnaire, and (5) data analysis. Data were analyzed using an independent t-test to compare the differences in the average posttest scores of students' critical thinking abilities between the control and experimental groups. Pearson correlation analysis was used to test the relationship between AQ and students' critical thinking abilities.

3. Results and Discussion

The results of the research conducted can be seen in the following tables. The pretest data was obtained from the scores of the prerequisite material that had been studied previously. Table 1 presents descriptive data of pretest data.

Table 1. Descriptive Statistics of Pretest Data

Class	N	Average	Standart Deviation
Kelas 12.1	29	84,7586	5,61665
Kelas 12.2	29	85,8276	5,90441
Kelas 12.3	30	84,8	3,12278
Kelas 12.4	28	83,6786	4,62724
Kelas 12.5	28	85,1786	2,90662

Next, a normality and homogeneity test was conducted on the pretest data using the Shapiro-Wilk test with a significance limit of 0.05, and the significance value of the pretest data of the five classes was less than 0.05 ($p < 0.05$). This means that the data in the five classes are not normally distributed. Then a non-parametric test was conducted, namely the Krukal-Wallis test, to compare the medians of three or more independent groups (Field, 2013). From the results of the test, it was obtained that the p value was 0.248, df 4 and Asymp. Sig. Of 0.248. These results indicate that there is no significant difference in the pretest values of the five classes. So two classes can be determined as research samples, namely the control class is class 12.4 and the experimental class is class 12.5.

Posttest data were obtained from the learning outcome scores obtained by students after participating in the learning and for measuring the Adversity Quotient (AQ) level, it was obtained from the questionnaire scores given to the control class and the experimental class. Table 2 presents descriptive statistics of the posttest scores of students' critical thinking skills and AQ questionnaire data in the control and experimental classes. The average posttest score in the control class was 20.8571 with a standard deviation of 2.04965. Meanwhile, the average posttest score in the experimental class was 22.9643, with a standard deviation of 2.83473. For the AQ questionnaire data, it is known that the average questionnaire data in the control class was 134.7143 with a standard deviation of 21.35564 and the average experimental class was 134.5714 with a standard deviation of 28.35807.

Table 2. Descriptive Statistics of Posttest Data and AQ Questionnaire

Data	Control Class		Eksperiment Class	
	Average	Standart Deviation	Average	Standart Deviation
Posttest	20,8571	2,04965	22,9643	2,83473
Angket AQ	134,7143	21,35564	134,5714	28,35807

Based on the data obtained from the Adversity Quotient (AQ) questionnaire, the grouping of students (respondents) based on the level of Adversity Quotient (AQ) is presented in the table below.

Table 3. AQ Categories of Control and Experimental Classes

Category	Control Class	Eksperiment Class
Climber (Tinggi)	9 (32%)	7 (25%)
Camper (Sedang)	10 (36%)	9 (32%)
Quitter (Rendah)	9 (32%)	12 (43%)
Total	28	28

In the control class, there were 9 students or 32% of the total number of students who were grouped in the Climber category, which means that the students have a high level of resilience to the difficulties and challenges that exist, and there were 10 students or 36% of the total number of students who were grouped in the Camper category, which means that the students have a moderate level of resilience to the difficulties and challenges that exist, and there were 9 students or 32% of the total number of students who were grouped in the Quitter category, which means that the students have a low level of resilience to the difficulties and challenges that exist. In the experimental class, there were 7 students or 25% of the total number of students who were grouped in the Climber category, which means that the students have a high level of resilience to the difficulties and challenges that exist, and there were 9 students or 32% of the total number of students who were grouped in the Camper category, which means that the students have a moderate level of resilience to the difficulties and challenges that exist, and there were 12 students or 43% of the total number of students who were grouped in the Quitter category, which means that the students have a low level of resilience to the difficulties and challenges that exist.

The results of the analysis of Adversity Quotient (AQ) of students from the control class and experimental class on the indicators of control, origin and ownership, reach, and endurance can be seen in the following table:

Table 4. Distribution of AQ Questionnaire Data based on indicators

Indicator	Total Score		Mean		Standart Deviation	
	K	E	K	E	K	E
Control	925	916	92,5	91,6	9,892	11,315
Origin and Ownership	960	976	96	97,6	9,726	11,893
Reach	925	936	92,5	93,6	9,922	9,531
Endurance	962	940	96,2	94	5,896	7,72

Description: K = Control Class; E = Experimental Class

Furthermore, the posttest data and AQ questionnaire data were subjected to prerequisite tests, namely normality and homogeneity tests. From the results of the prerequisite tests, it was found that the significance value for the normality of the control class posttest data was 0.641 and the experimental class was 0.176. This shows that the significance value of the two classes is more than the proposed significance limit of 0.05 ($p > 0.05$), so it is concluded that the posttest data of the two classes are normally distributed. Furthermore, from the results of the homogeneity test of the two classes, a significance value of 0.076 was obtained, this also shows that the posttest data has a homogeneous variance ($p > 0.05$). Normality and homogeneity tests were also carried out on the AQ questionnaire data, and the

results obtained were a significance value of the control class of 0.362 and the experimental class had a significance value of 0.519. This shows that the significance value of the two classes is more than the proposed significance limit of 0.05 (p> 0.05) so it is concluded that the AQ questionnaire data of the two classes are normally distributed. The results of the homogeneity test of the AQ questionnaire data in both classes show a significance value of 0.143. This also shows that the AQ questionnaire data has a homogeneous variance (p> 0.05).

From the results of the prerequisite test, it was found that both the posttest data and the AQ questionnaire met the assumptions required for parametric statistical tests, namely that the data was normally distributed and homogeneous, so the independent t-test would be used to compare the difference in the average posttest scores between the control and experimental groups, and the Pearson correlation would be used to analyze the relationship between Adversity Quotient (AQ) and students' critical thinking skills.

The independent t-test was conducted to compare the difference in the average posttest scores of students' critical thinking skills between the control and experimental groups. The results of the t-test obtained a value of t = -3.187, df = 54 and p = 0.002. Since the p value is less than 0.05 (p < 0.05), it is concluded that there is a significant difference in students' critical thinking skills between the control and experimental groups. The experimental group (mean = 22.9643) has a higher posttest score compared to the control group (mean = 20.8571). Cohen's d effect size is -0.852. This shows that there is a large effect size, which indicates that the use of the Problem Based Learning (PBL) model has a significant effect on improving students' critical thinking skills.

Furthermore, Pearson correlation analysis was conducted to determine the relationship between the Adversity Quotient (AQ) score and the posttest score of students' critical thinking skills. The results of the analysis showed a value of r = -0.166, and p = 0.221. Since the p value is greater than 0.05 (p > 0.05), there is no significant relationship between the Adversity Quotient (AQ) and students' critical thinking skills. The direction of the relationship is negative, meaning that the higher the Adversity Quotient (AQ) score of students, the lower the posttest score of critical thinking skills, but this relationship is not statistically significant.

The results of the study showed that the Problem Based Learning (PBL) model had a significant effect on improving students' critical thinking skills, as indicated by the results of the Independent t-test where the p value was obtained = 0.002 (p <0.05). This finding is in line with the principles of constructivism, which states that learning occurs effectively when students are actively involved in building their own knowledge (Jonassen, 1991). The PBL model provides a learning environment that allows students to build knowledge through direct experience, investigation, and problem solving. This is also in line with the findings of several previous studies including by Yulhendri and Yenni Oktafiani (2022) which showed that there was a significant influence on critical thinking skills and mathematics learning outcomes of high school students in grade X who were taught using the Problem Based Learning (PBL) method compared to those taught using conventional

learning methods. The implication of this finding is that teachers can consider using the PBL model as a learning strategy to improve students' critical thinking skills.

This study, like other studies, has several limitations that need to be considered in interpreting the results. First, the sample of this study was limited to grade XII students at one high school, namely SMAN 3 Tanjung Jabung Timur. This limits the generalization of the results of the study to a wider student population. The characteristics of students in other schools, both demographically and academically, may be different, so the results of this study may not be fully applicable to them. As noted by Shadish, Cook, & Campbell (2002), the generalization of research results is often limited by sample characteristics. A sample that comes from only one school, as in this study, may not be fully representative of the wider student population. Second, the instrument used to measure Adversity Quotient (AQ) is a questionnaire. Although the questionnaire has been validated, filling out the questionnaire is subjective and prone to bias. Student responses may be influenced by various factors, such as mood, understanding of the questions, or the desire to provide answers that are considered socially correct. This can affect the accuracy of AQ measurements. Tourangeau, Rips, & Rasinski (2000) explained that survey responses can be influenced by various cognitive and social factors. In this study, students may have difficulty understanding AQ questions or providing accurate responses for various reasons.

4. Conclusion

Based on the results of the research and data analysis conducted, it can be concluded that the use of the Problem Based Learning (PBL) model has a significant effect on improving students' critical thinking skills. This is indicated by the significant difference in posttest scores between the experimental group (PBL) and the control group. The effect size of Cohen's d is -0.852 (large effect). However, there was no significant relationship between Adversity Quotient (AQ) and students' critical thinking skills in this study.

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