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THE INFLUENCE OF THE OPEN-ENDED LEARNING MODEL ON CREATIVE THINKING ABILITY IN TERMS OF ADVERSITY QUOTIENT

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Abstract

Creative thinking ability is one of the essential skills that students must possess and is also a mandatory competence in accordance with educational objectives. The low level of creative thinking ability among Grade X students at MAN 2 Lampung Utara is one of the main concerns of this study. The aim of this research is to determine how students' creative thinking ability is influenced by the open-ended learning paradigm and Adversity Quotient (AQ), and to examine how the interaction between the learning model and AQ affects creative thinking ability. All Grade X students at MAN 2 Lampung Utara were involved as research subjects, with Class X-4 serving as the control group and Class X-5 as the experimental group, selected through cluster random sampling. An essay test consisting of four questions, validated both by experts and empirically, was used to measure creative thinking ability. The Adversity Response Profile (ARP) instrument, consisting of 30 items, was used to assess AQ. Two-way ANOVA was employed to evaluate the data. The conclusions drawn from the analysis are as follows: (1) students' creative thinking ability is significantly influenced by the use of the open-ended learning model; (2) students' creative thinking ability is significantly influenced by AQ; and (3) no interaction was found between the variables.

Keywords: *adversity Quotient (AQ); creative thinking skills; open-ended model*

1. INTRODUCTION

Education is a structured process designed to maximize human potential (human resources) through the organized and facilitated implementation of teaching and learning activities, enabling individuals to reach their full potential [1]. Education plays a crucial role in facing global competition [2]. Nadhiroh et al. also argue that education is the most essential component for progress [3].

Within the realm of education, there are various fields of study being explored, one of which is mathematics, which plays a vital role in developing students' knowledge and skills. Rudy et al. state that mathematics is an essential tool in shaping scientific thinking patterns, contributing to the development of students' critical, creative, logical, meticulous, and structured thinking abilities [4]. This serves as one of the main reasons why mathematics is integrated into the curriculum to foster students' creative thinking patterns.

Creativity can be understood as a process focused on generating new things that are unique, different, and original. This process emphasizes the creation of ideas or products that are not only innovative but also distinctive [5]. Creative thinking is the habit of using sharp reasoning combined with imagination to express new ideas as extensions of previous ones, aiming to find solutions to problems [6]. Meanwhile, creative thinking ability refers to the potential that enables individuals to produce unconventional, unique, and previously unformulated solutions [7].

However, in practice, creative thinking skills in mathematics learning often receive little attention from most teachers, which contributes to the low level of students' creative thinking ability in Indonesia [8].

Maya et al. revealed that students at the Vocational High School in Gelanggang Village still demonstrated a low level of creative thinking [9]. A similar finding was reported by Irma et al., who stated that students' creative thinking skills at SMPN 1 Cipatujah were categorized as low due to ineffective teaching approaches [10]. Students at MAN 2 Lampung Utara also exhibit low creative thinking abilities. The results from the preliminary research phase support this statement.

Table 1. Results of the Preliminary Test on Creative Thinking Ability

Category	Score Range	Number of Students	Percentage
Very Low	$X < 1{,}36$	0	0%
Low	$1{,}36 < X \leq 15{,}36$	14	54%
Moderate	$15{,}36 < X \leq 29{,}36$	6	23%
High	$29{,}36 < X \leq 43{,}36$	2	8%
Very High	$X > 43{,}36$	4	15%
Total		26	100%

Table 1 shows that 54% of students possess low to very low levels of creative thinking ability, while 46% fall within the moderate to very high category. These results indicate that the creative thinking capacity of students at MAN 2 Lampung Utara is still considered inadequate.

One of the key contributing factors to this condition is the limited use of instructional models that are specifically designed to actively engage and stimulate students in developing their creative thinking abilities. The lack of such pedagogical approaches may hinder students from exploring diverse perspectives, generating original ideas, and constructing innovative solutions in the learning process [11]. A positive correlation was also found between the collected data and insights provided by a mathematics teacher, Mrs. Sudesti Vindi Pratiwi, S.Pd., who reported that students generally struggle to solve problems that differ in structure from those they have previously encountered. As a result, they require gradual

scaffolding and guidance when approaching unfamiliar tasks. Consequently, the predominant instructional model used in the classroom remains conventional, with a strong emphasis on the teacher's active role and limited opportunities for student-centered exploration.

Open-ended learning is an instructional approach or model designed to encourage students to think creatively, critically, and divergently by presenting open-ended problems that allow for multiple possible answers or solution strategies. In this type of learning, students are not directed to arrive at a single correct answer but are instead given the freedom to explore a variety of ideas and solutions based on their individual understanding and creativity. In the present study, open-ended learning is applied as a learning model, as it is considered to be highly relevant and has great potential to support the achievement of the intended learning objectives. The syntax of the open-ended learning model includes the following steps: (1) presenting a problem, (2) designing the learning process, (3) observing and recording student responses, (4) guiding and facilitating students, and (5) drawing conclusions [12].

This learning model presents problems that can be solved through multiple alternative solutions or methods, thereby providing students with opportunities to gain experience, develop understanding, and address issues using various approaches that align with their individual potential and abilities [13]. The effectiveness of this model in enhancing students' creative thinking skills is supported by findings from previous studies. For instance, research by [14] and [12] indicates that Adversity Quotient (AQ) can support and influence other cognitive abilities, including creative thinking, critical thinking, and problem-solving.

Creative thinking ability refers to an individual's skill in generating new ideas or approaches to solving problems and creating products [15]. It is a potential that enables a person to develop unconventional, unique, and previously unformulated

solutions [7]. The key indicators of creative thinking ability include: (1) (1) Fluency – the ability to produce a large number of ideas or responses; (2) Flexibility – the capacity to generate diverse ideas from different perspectives; (3) Originality – the ability to produce ideas that are novel or rare; and (4) Elaboration – the skill of adding detail, depth, or complexity to an idea [3], [16].

In this study, the researcher is particularly interested in examining students' Adversity Quotient (AQ). AQ refers to an individual's capacity to respond to and manage life's challenges by optimizing their intellectual potential, thereby enabling them to handle obstacles effectively and efficiently [7]. AQ reflects the extent to which a person can endure adversity and how well they are able to cope with such difficulties [17]. Previous studies [18]–[20] have not explicitly or specifically examined the application of the open-ended learning model in relation to students' creative thinking abilities with a particular focus on Adversity Quotient at MAN 2 Lampung Utara. Therefore, this study seeks to fill that gap by exploring the interaction between AQ and the open-ended learning model in enhancing students' creative thinking skills.

Based on the above explanation, both creative thinking ability and Adversity Quotient (AQ) are closely related to students' problem-solving processes. AQ, which measures an individual's resilience in facing challenges and difficulties, is an essential component to consider when evaluating creative thinking skills [17]. Therefore, the researcher conducted a study entitled: "The Effect of the Open-Ended Learning Model on Creative Thinking Ability in Terms of Students' Adversity Quotient (AQ)."

2. RESEARCH METHOD

The design used in this study is quasi-experimental. This design includes and involves the presence of a control group; however, external factors that may influence the experiment cannot be fully controlled by the control group [21]. The specific quasi-experimental design employed by the researcher is the Non-Equivalent Control Group Design, in which both the experimental and control groups are given a pre-test and a post-test.

The population of this study consisted of tenth-grade students at MAN 2 Lampung Utara in the 2024–2025 academic year. The total number of students was 180, divided into five classes. The sample for this study was selected using a cluster random sampling technique, which involves random selection based on class groups. Through this method, two classes—Class X-4 and Class X-5—were selected as the research sample.

To collect data on students' creative thinking abilities, the researcher used an essay-type test as the instrument, administered to students on the topic of probability. Before being used in the study, the test instrument underwent validation procedures, including tests for validity, discrimination index, difficulty level, and reliability. To measure Adversity Quotient (AQ), the researcher used a questionnaire-based instrument known as the Adversity Response Profile (ARP). In this study, the ARP was adapted from the book [22]. The ARP used has been validated and has been tested on more than 7,500 individuals from various companies, schools, and athletic teams. The ARP consists of 30 questions that describe various life events.

After all the data were successfully collected, the next step was to analyze the data to verify the hypotheses. A two-way ANOVA test was used as the statistical parametric analysis approach in this study. Normality and homogeneity tests were conducted as prerequisite tests before performing the two-way ANOVA.

3. RESULTS AND DISCUSSION

Instrument Trial Results

a. Validity Test

The content validity test was conducted through expert judgment, involving two lecturers from the University of Muhammadiyah Kotabumi and one mathematics teacher. The content validation was carried out by Mrs. Ratih Handayani, S.Pd., M.Pd., Mrs. Fhela Vhantoria Ningrum, S.Pd., M.Pd., and Mr. Suryadi, S.Pd. The result of the content validation in this study indicated that the creative thinking skills instrument was highly valid, with several improvements suggested.

b. Discrimination Index Test

The following presents the results of the discrimination index test of the instrument used in this study.

Table 2. Discrimination Index Table

Item Number	Discrimination Index	Criteria
1	0,38281	Fair
2	0,41406	Good
3	0,51562	Good
4	0,46875	Good

Based on the data presented in Table 2, it is known that one item falls into the fair category, while the other three items are categorized as good. Thus, the results of the discrimination index test indicate that all four items meet the eligibility criteria for use.

c. Difficulty Level Test

According to Rahman & Nasyrah, an item is considered to be of good quality if its difficulty level falls into the moderate category—that is, it is neither too easy nor too difficult [23]. The

test items used in this study have difficulty index values ranging from $0.30 \leq P \leq 0.70$. Based on the analysis, the difficulty index scores for each item in order are: 0.437, 0.310, 0.427, and 0.470. These results indicate that each item falls within the acceptable range of $0.30 \leq P \leq 0.70$, and therefore, all four items are classified as having a moderate level of difficulty. As a result, all items are considered usable, and none were discarded.

d. Reliability Test

Based on the results of the discrimination index and difficulty level tests, four questions were selected to be used as instruments for measuring creative thinking ability. These items were then tested for reliability using the Cronbach's Alpha method, resulting in a reliability coefficient of r_{11} = 0,893195. Since this value exceeds the threshold of 0.70, it can be concluded that the instrument has a high level of reliability and is suitable for use.

Data Analysis Results

a. Creative Thinking Ability Data

The summary of the post-test scores of both classes is presented in the following table.

Table 3. Creative Thinking Ability Scores of the Control and Experimental Classes

Class	X_{maks}	X_{min}	$\bar{X}$	Me	SD	Total Students
Control	64,06	29,69	49,32	50	8,42	32
Experimental	85,95	37,5	57,76	57,03	10,91	32

Based on the data presented in Table 18, following the implementation of the treatment in the experimental group, the highest score recorded was 85.94, while the lowest was 37.5. In

comparison, the control group achieved a maximum score of 64.06 and a minimum of 29.69. The average score of the experimental group reached 57.76, whereas the control group had an average of 49.32. These differences in maximum, minimum, and mean scores indicate a variation in creative thinking ability between the two groups.

b. Adversity Quotient (AQ) Data

Data on Adversity Quotient (AQ) were collected through the distribution of questionnaires to students. This information was used to identify the AQ type of each student participating in the study. There are three AQ types: Quitters (low), Campers (moderate), and Climbers (high).

Table 5. Criteria for AQ Category Grouping

Score Interval	AQ Type
$X \geq \bar{x} + SD$	Climbers
$\bar{x} - SD \leq X < \bar{x} + SD$	Campers
$X < \bar{x} - SD$	Quitters

Source: [24]

Based on the calculation results, the average score (X̄) was 119 and the standard deviation (SD) was 25. The distribution of students according to the three types of Adversity Quotient (AQ) in both classes is presented in the table below.

Table 6. Student Classification Based on AQ Categories

AQ Category	Score Interval	Number of Students	
		Control	Experimental
Climbers	X ≥ 144	8	7
Campers	94≤ X <144	16	16
Quitters	X < 94	8	9
Total		32	32

Assumption Testing Results

a. Normality Test

The Liliefors test was used in this study at a 5% significance level. The table below presents the results of the normality test conducted on the posttest and AQ data from both groups.

Table 7. Summary of Normality Test Results

No	Variable	L_{hitung}	L_{tabel}	Decision	Conclusion
1	Experimental.(A_1)	0,1338	0,15662	H_0 accepted.	Normal
2	Control.(A_2)	0,0827	0,15662	H_0 accepted.	Normal
3	Quitters.(B_1)	0,1315	0,206	H_0 accepted.	Normal
4	Campers.(B_2),	0,0789	0,161	H_0 accepted.	Normal
5	Climbers.(B_3),	0,1388	0,220	H_0 accepted..	Normal

Since each group has a calculated $L_{hitung} < L_{tabel,}$, the results of the normality test indicate that the data from all groups are normally distributed.

b. Homogeneity Test

Bartlett's test was used to examine the homogeneity of variances at a significance level of α = 0,05.

Tabel 8 Summary of Homogeneity Test

No	Variable	b_{hitung}	b_{tabel}	Decision	Conclusion
1	A_1, A_2	0,9676	0,9381	H_0 accepted.	Homogen
2	B_1, B_2, B_3	0,9325	0,9039	H_0 accepted.	Homogen
3	$A1B1, A1B2, A1B3,$ $A2B1, A2B2, A2B3$	0,9505	0,8194	H_0 accepted.	Homogen

H_0 is accepted if $b_{obs} \notin DK$, from table 22 it can be seen that: DK = {b|b < 0,9381} for Group 1, DK= {b|b < 0,9039} or Group 2, dan DK= {b|b < 0,8194} or Group 3. Based on the results of the homogeneity test analysis, each group has a $b_{obs} \notin DK$, This indicates that the three groups have homogeneous variances.

Hypothesis Testing Results

Table 9. Two-Way ANOVA Test Results on Students' Creative Thinking Ability

Sumber	JK/ SS	DK / df	RK	$F_{hit/calculate}$	$F_{a/critic}$	Test Decision
Learning Model (A)	1361,19366	1	1361,19366	53,6525065	4,01	H_{0A} rejected
AQ (B)	5326,83928	2	2663,41963	104,980756	3,16	H_{0B} rejected
Interaction	158,554266	2	79,2771331	3,12476984	3,16	H_{0AB} accepted
Error	1471,49	58	25,37055115	-	-	
Total	8318,08	63	-	-	-	

The decision criterion for the two-way ANOVA analysis is that $F_{hitung} \epsilon DK$. Based on Table 9, the test statistic for H_{0A} is F_{hit} = 53,6525 and $F_{0,05;1,58}$ = 4,01 In fact $F_{hitung} \epsilon DK$ therefore H_{0A} rejected. This indicates that the open-ended and conventional learning models differ in terms of the mean scores of students' creative thinking abilities. Therefore, it can be concluded that students' capacity for creative thinking is significantly influenced by the use of the open-ended learning model. Regarding the statistical value H_{0B} that is F_{hitung} = 104,9808 and $F_{0,05;2,58}$ = 3,16 Therefore $F_{hitung} \epsilon DK$ that is H_{0B} rejected. This indicates that there are significant differences in creative thinking abilities at the 0.05 significance level depending on the students' AQ types—namely climbers, campers, and quitters. Therefore, it is concluded that students' capacity for creative thinking is significantly influenced by their AQ. For the statistical test value H_{0AB} where F_{hitung}= 3,1248 and $F_{0,05;2,58}$= 3,16 that is $F_{hitung} \notin DK$ therefore H_{0AB} is accepted. This shows that the open-ended learning model, in relation to Adversity

Quotient (AQ), does not have an interaction effect on students' creative thinking ability.

Follow-up Test Results

The rejection of the second hypothesis (H_0B) necessitated further analysis to specifically identify the effects of each AQ type. This was carried out using multiple comparisons between columns with the Scheffé method at a significance level of $\alpha = 0.05$.

Table 10. Results of the Multiple Comparison Test

H_0	$F_{hit/calculated}$	$F_{critical}$	Decision
$\mu 1 = \mu 2$	48,61319	6,312	H_0 Rejected
$\mu 1 = \mu 3$	164,6855	6,312	H_0 Rejected
$\mu 2 = \mu 3$	61,4766	6,312	H_0 Rejected

Based on the data presented in Table 10, all three null hypotheses were rejected. Students with the Climbers type of Adversity Quotient (AQ) demonstrated higher creative thinking abilities compared to those categorized as Campers and Quitters. Furthermore, students identified as Campers also tended to exhibit better creative thinking skills than those classified as Quitters.

Discussion

1. The influence of the Open-Ended Learning Model on Creative Thinking Ability

Compared to students in the control group who used conventional learning strategies, students in the experimental class who applied the open-ended learning model demonstrated a higher average level of creative thinking ability. This conclusion is based on the findings of the two-way analysis of variance hypothesis test. These results are consistent with research conducted by Monica and Lailiyah, which showed that the use of the open-ended learning paradigm can

enhance students' creative thinking skills. Therefore, these data support the first hypothesis of this study, which states that the development of students' creative thinking ability is influenced by the open-ended learning paradigm.

2. The Influence of Adversity Quotient (AQ) on Creative Thinking Ability

The results of the hypothesis test indicate that $F_{0,05;2,58}$ = 3,16 and F_{hit} = 104,9808. The rejection of H_{0B} occurred because the F_{hit}value falls within the rejection region. This indicates that, depending on the students' AQ types, there is a significant difference in their creative thinking abilities at a significance level of α = 0.05. To determine the specific impact of each AQ type, an additional test using the Scheffé method was conducted at the 0.05 significance level. The findings showed that students with the Climbers AQ type demonstrated higher creative thinking ability compared to those with Quitters or Campers AQ types. Furthermore, students with the Campers AQ type were also more proficient in creative thinking than those categorized as Quitters.

These results are consistent with the research by Nursa'adah & Rosa, which demonstrated the influence of AQ type on creative thinking ability, and also support the second hypothesis [25]. These findings are further aligned with the study by Ningrum, which found that students with the Climbers AQ type exhibited greater creative thinking ability compared to those with the Campers or Quitters types, and that Campers outperformed Quitters in terms of creative thinking. Based on the above, the second hypothesis is confirmed.

3. Interaction between variables

The result of the interaction between variables, based on the statistical value obtained from the two-way analysis of variance, yielded F_{hit}= 3,1248 dan $F_{critical}$= 3,16. The Hypothesis H_{0AB} is accepted because theF_{hit} does not fall within the critical region. This indicates that at a significance level of α = 0.05, the open-ended learning model does not interact with creative thinking ability in terms of adversity quotient (AQ). Therefore, no further testing is required. The influence of the open-ended learning model on creative thinking ability is consistent across all AQ types, and the influence of AQ type on creative thinking ability is not dependent on the learning model used, as there is no interaction between the variables.

The researcher did not further explore open-ended problems, resulting in a lack of interaction in this study. Consequently, the student worksheets (LKPD) developed by the researcher were not aligned with the types of creative thinking questions needed for the open-ended learning process. The problems in the LKPD remained general in nature, limiting students' ability to freely develop their own ideas. Ideally, AQ and the learning model should interact with students' capacity for creative thinking. The findings of this study include: (1) serving as best practices for students and schools due to the innovation and alternative learning strategies offered; (2) providing AQ ability data in schools where such measurements had never been conducted before; and (3) demonstrating that the implementation of the open-ended learning model can improve students' creative thinking abilities.

4. CONCLUSION & RECOMMENDATIONS

Based on the conceptualization of the problem, data analysis, and hypothesis testing, the following results were obtained: (a) Students' capacity for creative thinking is significantly influenced by the use of the open-ended learning model; (b) Compared to students in the Campers and Quitters categories, students categorized as Climbers in terms of Adversity Quotient (AQ) demonstrated a higher level of creative thinking ability. Additionally, students with the Camper AQ type were more proficient in creative thinking than those with the Quitter AQ type; (c) There is no interaction between students' creative thinking ability and the use of the open-ended learning model when viewed from the perspective of AQ. The recommendations provided are as follows: (a) Innovative teaching strategies, such as the open-ended learning model, should be implemented by educators to enhance students' creative thinking skills; and (b) This study shows that students' capacity for creative thinking is influenced by their Adversity Quotient, as this trait has been proven to support the development of creative thinking throughout the learning process. Therefore, teachers are encouraged to consider the type of Adversity Quotient possessed by their students.

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