UJME 12 (1) 2023: 72-83
UNNES JOURNAL OF MATHEMATICS EDUCATION
https://journal.unnes.ac.id/sju/index.php/ujme/
ISSN: 2252-6927 (print); 2460-5840 (online)

Mathematical Creative Thinking Ability Viewed by Adversity Quotient in Problem-Based Learning Integrated STEM

Khoiriyatul Hidayah[a,*], Dwijanto[a]

[a,]Mathematics Department, Universitas Negeri Semarang, Sekaran Campus,Gunungpati, Semarang, 50229, Indonesia

* E-mail address: khoiriyatulhidayah.students.unnes.ac.id

ARTICLE INFO

Article history:
Received 27 January 2023
Received in revised form 20 February 2023
Accepted 30 March 2023

Keywords:
Mathematical Creative Thinking Ability;
Adversity Quotient;
Problem-Based Learning integrated STEM

Abstract

The purpose of this study was (1) to knowing the average test results of students' mathematical creative thinking abilities with the Problem-Based Learning integrated STEM to achieve standard of minimum completeness of mastery learning and classical mastery; (2) to find out students' creative thinking abilities with Problem-Based Learning integrated STEM is better than students' creative thinking abilities with Discovery Learning models; (3) to find out students' mathematical creative thinking ability increase in Problem-Based Learning integrated STEM; (4) to determine and describe the effect of Adversity Quotient on students' mathematical creative thinking ability in the Problem-Based Learning integrated STEM. The method used was a mixed method with a sequential explanatory design. In this research, 6 research subjects were taken based on the level of Adversity Quotient in experimental class. Research results show that (1) the average test results for students' mathematical creative thinking ability using the Problem-Based Learning integrated STEM achieved standard of minimum completeness of mastery learning and classical mastery; (2) students' creative thinking abilities with the Problem-Based Learning integrated STEM are better than students' creative thinking abilities with Discovery Learning models; (3) there was an increase in students' mathematical creative thinking skills in the Problem-Based Learning integrated STEM model; (4) there is an influence of the Adversity Quotient on students' mathematical creative thinking abilities in the Problem-Based Learning integrated STEM; S-1, S-2, S-3, S-4 and S-5 are not yet able to fulfill the four indicators of mathematical creative thinking ability, and S-6 fulfills the four indicators of mathematical creative thinking ability.

1. Introduction

The 21st century is referred to as the century of knowledge marked by the rapid development of technology and information in all aspects of life. So that in facing various challenges and demands in the 21st century, there is a need for learning and practice to prepare a quality 21st century generation, namely through 21st century learning which is known as students-centered learning. According to Mardhiyah et al (2021) 21st century learning applies creativity, critical thinking, collaboration, problem solving, communication skills, community skills and character which aims to make students have skills in thinking and learning skills in the 21st century, or what is known as “The 4C Skills” formulated by the Partnership Framework of 21st Century Skills, which includes communication, collaboration, critical thinking and problem solving, and creative and innovative.

In Law Number 20 of 2003 concerning the National Education System it is stated that one of the goals of education is to develop the potential of students, one of which is in ability, namely mathematical ability. Rahmah (2018) defines mathematics as an activity that places more emphasis on the world of ratios (reasoning), does not emphasize the results of experiments or observations, mathematics is formed because of human thoughts, which are related to ideas, processes and reasoning. The purpose of learning

To cite this article:
Hidayah, K. & Dwijanto, D. (2023). Mathematical Creative Thinking Ability Viewed by Adversity Quotient in Problem-Based Learning Integrated STEM. *Unnes Journal of Mathematics Education*, *12*(1), 72-83. doi: 10.15294/ujme.v12i1.67560

mathematics is to train and develop students in ways of thinking systematically, logically, creatively, critically, consistently, developing an attitude of never giving up and confidence in problem solving.

Widi Trisna Putri & Ratu (2018) states creative thinking as a step or method for responding to or developing developments and changes in more difficult problems or issues. Sumartini (2019) explains that when solving mathematical problems, creative thinking is required to be able to present many ideas in a unique way and provide detailed explanations for solving mathematical problems. This is in line with Anditiasari et al. (2021) that explains creative ability is the ability to express ideas or ideas to solve a problem and produce new ones or have not been discovered by others.

Based on the results of the Program for International Student Assessment (PISA) survey in 2018, it shows that Indonesia is still relatively low in mastery of the material and the low ability of students to think creatively in solving PISA questions. This is shown by Indonesia being ranked 72nd out of 78 countries with an average math score of 379, which means it has decreased from PISA 2015 by 7 points (PISA, 2019). In addition, based on The Global Creativity Index score in 2015, it shows that of all creativity which includes aspects of technology, talent, and tolerance, Indonesia is ranked 115 out of 139 countries (Florida et al., 2015).

To improve the ability to think creatively, especially in solving mathematical problems, you can get used to it through a learning model. According to Rizqi et al. (2019), problem-based learning is a learning model that encourages students to understand the material and apply their knowledge in solving everyday problems. Problem based learning is a practical problem-based learning model that can stimulate and encourage learners to apply what has been learned to solve problems and think critically, creatively, analytically, systematically, and logically through empirical data exploration, thus developing scientific attitudes (Winoto & Prasetyo, 2020).

To train students to become more creative human beings, exercises are needed that provide opportunities for them to use their intellect, develop ideas, find solutions to problems that are close to them, problems they find in everyday life, STEM is very suitable to be applied because it requires students to apply several scientific disciplines to solve everyday problems. The goals of STEM in education are in line with the demands of 21st century education. In Jauhariyyah et al. (2017) quoted from Bybee and the National STEM Education Center states that the purpose of STEM is for students to have scientific and technological literacy which can be seen from reading, writing, observing, and doing science, and being able to develop the competencies they already have to apply them in dealing with problems in everyday life related to the field of STEM science.

In several studies mentioned by Widowati et al. (2021) shows that STEM learning can be achieved through Problem-Based Learning (PBL). This is because the purpose of the PBL learning model is to help students understand concepts more deeply, build confidence in dealing with problems, build cooperation in teams, train students to take a systematic approach to solving problems, make decisions and present them, and hold competitions to get results. better, so that STEM learning matches the characteristics of PBL learning.

According to Nurjanah et al. (2019), a person's success in developing a skill, especially the ability to think creatively, can be influenced by several factors, namely internal factors and external factors. Among them are the internal factors that can influence the learning outcomes, namely the adversity quotient (AQ) of students. Leonard & Amanah (2014) consider adversity quotient as the greatest strength in a person to solve existing problems, this is what causes AQ to be called one of the keys to success.

This was also reinforced by the results of interviews conducted with State Junior High School Negeri 1 Tayu teachers that the creative thinking abilities of Grade VIII students still needed to be improved which was indicated by students who still had difficulty solving math problems that were different from the examples given by the teacher. In addition, teachers in teaching tend to be monotonous or less varied and have not been able to develop students' creative thinking skills by giving questions that are not routine.

Based on the description above, the authors are interested in conducting research entitled “Mathematical Creative Thinking Ability Viewed by Adversity Quotient in Problem-Based Learning Integrated STEM”. This study aims to: (1) to knowing the average test results of students' mathematical creative thinking abilities with the Problem-Based Learning integrated STEM to achieve standard of minimum completeness of mastery learning; (2) to determine students' mathematical creative thinking abilities with the Problem-Based Learning integrated STEM achieves classical mastery; (3) to find out students' creative thinking skills with Problem-Based Learning integrated STEM is better than students' creative thinking abilities with conventional learning models; (4) to find out students' mathematical creative thinking ability increase in Problem-Based Learning integrated STEM is better than improving students' mathematical creative thinking skills in conventional learning models; (5) to determine the effect of Adversity Quotient on students' mathematical creative thinking ability in the Problem-Based Learning integrated STEM; (6) to describe the effect of Problem-Based Learning integrated STEM on students' mathematical creative thinking abilities in terms of Adversity Quotient.

2. Methods

The research method used in this study was a mixed methods with sequential explanatory design. Quantitative research design uses True Experimental Design the form Pretest-Posttest Control Group Design. The description of the quantitative research design can be seen in Table 1.

Table 1. Research methods.

Group	Pretest	Treatment	Posttest
A	O_1	X	O_2
B	O_3	Y	O_4

Information:
A: experimental group
B: control group
O_1: mathematical creative thinking ability pretest in experimental group
O_2: mathematical creative thinking ability posttest in experimental group
O_1: mathematical creative thinking ability pretest in control group
O_2: mathematical creative thinking ability posttest in control group
X : Problem-Based Learning Integrated STEM
Y : Discovery Learning

The population in this study comrpised 8th-grade students at State Junior High School Negeri 1 Tayu in the first semester 2022/2023 period. The sample consistesd of grade VIII-B students, who were treated as the experimental with Problem-Based Learning integrated STEM and grade VIII-E students, who were treated as the control group treated with Discovery Learning. The sample were selected using a cluster random sampling technique. The subjects were chosen through purposive sampling technique.

In the study, students were given an adversity quotient questionnaire. Then, classified in students with high, and average adversity quotient. Only students with moderate AQ and high AQ were found in the study. There are 6 subjects were chosen to be analyzed, with high adversity quotient, and with average adversity quotient.

Data collection methods in this study are test, questionnaire, and interview methods. The purpose of the interview is to know the student's mathematical creative thinking ability on each category of adversity quotient level.

Data analysis in the study involved a prerequisite test analysis, data analysis of mathematical creative learning ability test result, and qualitative data analysis. The prerequisite test analysis included normality test to determine if the sample groups were from a normal distributed population, homogeneity test to determine if the sample groups had homogeneous variances, and the test for similarity of two averages to determine if the sample groups had the same basic abilities. The normality test used the Kolmogorov Smirnov test, homogeneity test used the Levene test, and the test for similarity of two averages were performed with Independent-Sample T-Test with SPSS 25.0 assistance. The results showed that the sample groups were from a normally distributed population, had homogeneous variances, and had the same basic abilities.

The analysis of mathematical creative thinking ability test and adversity quotient questionnaire was used to answer the problem formulation of effect of Adversity Quotient on students' mathematical creative thinking ability in the Problem-Based Learning integrated STEM. After that, qualitative data analysis was used to describe the students' mathematical creative thinking abilities viewed from adversity quotient in Problem-Based Learning Integrated STEM.

Qualitative data analysis techniques in the study included data reduction, data display, and conclusion drawing. The validity of the study was determined through a triangulation test, which used technique triangulation.

3. Results & Discussions

3.1. Initial Data Analysis

Initial data analysis was used for one of the references of sample selection by conducting normality tests, homogenity tests and similarity of the two average tests. After testing for normality, homogeneity, and similarity of the two averages in the two classes, the data obtained from a normal distribution, has the same variance (homogeneous), and there was no difference between the two classes.

3.2. Quantitative Data Analysis

The data intended in quantitative research are posttest scores of students in the experiment class and the control class. Before testing the hypothesis, the data obtained were first tested for normality and homogeneity. After testing for normality and homogeneity in both classes, the results show that the data are normally distributed and have the same variance (homogeneous), so that it can be continued with hypothesis testing. Here are the research data presented in Table 2.

Table 2. Research methods.

Class	N	$\bar{x}$	The Highest Score	The Lowest Score
The Experiment	33	79.167	95	67.5
The Control	33	73.18	87.5	57.5

The achievement of learning in this research is the average test results of students' mathematical creative thinking abilities with the Problem-Based Learning integrated STEM learning model to achieve mastery learning criteria, students' mathematical creative thinking abilities with the Problem-Based Learning integrated STEM learning model achieves classical mastery, students' mathematical creative thinking ability with Problem-Based Learning integrated STEM learning model is better than students' creative thinking abilities with conventional learning models, students' mathematical creative thinking ability increase in Problem-Based Learning integrated STEM learning model is better than improving students' mathematical creative thinking ability in conventional learning models, and there is an influence between Adversity Quotient with students' mathematical creative thinking ability in the Problem-Based Learning integrated STEM learning model.

The first hypothesis in this study is the average test results of students' mathematical creative thinking abilities with the Problem-Based Learning integrated STEM learning model to achieve standard of minimum completeness of mastery learning that is calculated using one sample t-test (right side). In testing hypothesis 1, the data used is the result of the posttest mathematical creative thinking abilities of class VIII-B. Based on calculations, the average score of students' mathematical creative thinking ability tests in the experimental class was 79.167. This shows that the average test scores for students' mathematical creative thinking ability through the Problem-Based Learning integrated STEM model reach the standard of minimum completeness of mastery learning. Then it is reinforced by the calculation of the average minimum completeness test on the right side of the posttest results of students' mathematical creative thinking abilities in the experimental class, it is obtained that $t_{count} = 8.198$ and $t_{table} = 1.693$ because $t_{count} > t_{table}$ then H_0 is rejected. So, it can be concluded that the average posttest score of students' mathematical creative thinking ability through the Problem-Based Learning integrated STEM learning model reaches standard of minimum completeness of mastery learning.

Hypothesis 2 was tested using a classical mastery test which aims to determine whether mathematical creative thinking ability in Problem-Based Learning integrated STEM can achieve classical mastery. The classical completeness criteria used are 75% of the results of students' mathematical creative thinking abilities reaching a value of 68. Based on calculations, the number of students who completed the standard of minimum completeness of mastery learning in the experimental class was 30 students or equal to 90.9%. This shows that students through the Problem-Based Learning integrated STEM learning model achieve classical mastery. Then it is strengthened by the calculation of the classical completeness proportion test on the right side of the posttest results of students' mathematical creative thinking ability in the experimental class obtained $z_{count} = 2.133$ dan $z_{table} = 1.64$ because $z_{count} > z_{table}$ then H_1 is accepted. So, it can be concluded that the proportion of students' posttest scores through the Problem-Based Learning integrated STEM learning model achieves classical mastery. This is in accordance with research conducted by Sari & Masrukan (2022) that the results of classical learning completeness of students using the PBL model reach more than 75%. According to Vistara et al. (2022) learning Problem-Based Learning with STEM nuances can improve students' creative thinking skills which do not only focus on solving mathematical problems, but students also gain new knowledge about scientific disciplines so that they can use other knowledge included in STEM and are able to develop their thinking to solve the problems encountered.

Hypothesis 3 was tested using a t-test, namely the Independent Sample T-Test. This test was conducted to determine whether the average mathematical creative thinking ability of students in Problem-Based Learning integrated STEM was better than the average mathematical creative thinking ability of students in Discovery Learning. Based on calculations, the posttest average score for students' mathematical creative thinking abilities in the experimental class was 79.167 and in the control class was 73.182. This shows that the average posttest scores of students through the Problem-Based Learning integrated STEM learning model are better than the average posttest results of mathematical creative thinking skills using the Discovery Learning model. Then it is strengthened by the calculation of the two-sided difference test on the right side of the posttest results of mathematical creative thinking abilities. In the average similarity test obtained with $t_{table} = 1.669$, obtained $t_{count} = 2.924$. Based on the test criteria, because $t > t_{1-\alpha}$ then H_1 is accepted. So it can be concluded that the average mathematical creative thinking ability of students in Problem-Based Learning integrated STEM is more than the average mathematical creative thinking ability of students in Discovery Learning.

Then proceed with testing the similarity of the two proportions. This test was conducted to determine whether the proportion of mathematical creative thinking abilities of students in Problem-Based Learning integrated STEM was better than the proportion of mathematical creative thinking abilities of students in Discovery Learning. Based on calculations, the number of students who achieved standard of minimum completeness of mastery learning in the experimental class was 30 students or the equivalent of 90.9% and in the control class there were 22 students or the equivalent of 66.67%. This shows that the average posttest score of students' mathematical creative thinking abilities through the Problem-Based Learning integrated STEM learning model is better than the average posttest results of students' mathematical creative thinking abilities using the Discovery Learning model. Then it is strengthened by the calculation of the similarity test of the two proportions of the right side of the posttest results of mathematical creative thinking abilities. In the similarity of the two proportions test obtained with $z_{table} = 1.64$, obtained $z_{count} = 2.42$. Based on the test criteria, because $z > z_{0,5-\alpha}$ then H_1 is accepted. So, it can be concluded that the proportion of mathematical creative thinking ability in the Problem-Based Learning integrated STEM learning model is better than the proportion of students' mathematical creative thinking ability with the Discovery Learning model. The following is a Problem-Based Learning integrated STEM, so that the average and proportion mathematical creative thinking ability of students in the treatment class becomes better.

In testing hypothesis 4, The data used are pretest and posttest data for students' mathematical creative thinking abilities in the experimental class. Test hypothesis 4 using the gain test. Based on calculations, the average pretest value of students' mathematical creative thinking abilities in the experimental class was 40.152 and the average posttest value of students' mathematical creative thinking abilities in the experimental class was 79.167. This shows that there is an increase in the average pretest score to the posttest score of students' mathematical creative thinking abilities. Then it is strengthened by paired sample t-test.

Table 3. Problem-Based Learning integrated STEM

Activity	Activity Description
Phase 1: Student Orientation on Problems	1. The teacher displays the problems presented on students' worksheet 2. Students are asked questions related to material problem
Phase 2: Organizing students to learn	1. The teacher provides an explanation regarding the problem and gives students the opportunity to play an active role in solving the problem. 2. The teacher divides students into several groups to discuss material concepts as a solution to problems through students' worksheet 3. Students discuss to work on students' worksheet
Phase 3: Guiding Individual and Group Investigations	1. The teacher encourages students to collect appropriate information, seek explanations and solutions to the problems given. 2. The teacher guides students in filling out the students' worksheet by answering students' difficulties.
Phase 4: Developing and Presenting the Work	1. Students present solutions that have been found related to problems given by the teacher. 2. Students discuss or do question and answer activities in large groups, namely all students.
Phase 5: Analyzing and Evaluating the Problem Solving Process	1. The teacher confirms the answers obtained by the students. 2. At the end of the meeting, students are given a quiz which is used as an evaluation of students' problem solving abilities

On the results of the paired sample t-test, the pretest and posttest values of students' mathematical creative thinking abilities using it, it can be seen that the value of Sig. (2-tailed) is $0.000 < 0.05$, then Ho is rejected. This means that there is a difference in the average pretest and posttest scores for the ability to think creatively mathematically in the Problem-Based Learning integrated STEM learning model. Furthermore, to find out the increase in pretest to posttest scores for each student in the experimental class using the N-Gain test, the average pretest score was 40.152 and the average posttest score was 79.167. In order to obtain an N-Gain value of 0.651. This means that class VIII-B has increased learning outcomes in the moderate category. Therefore, it can be concluded that the average increase in students' mathematical creative thinking abilities in STEM integrated Problem-Based Learning is included in the classification with moderate interpretation. This is supported by Rizqi et al. (2019) which revealed that the ability to think creatively mathematically through a problem-based learning model in the experimental class could improve students' cognitive outcomes higher than that of the control class with a gain of 0.39. In addition, based on research by Dewi & Harjono (2021), it was revealed that the normality test for class gain with the PBL learning model in improving students' mathematical creative thinking abilities has an average of 0.71, which means that they have experienced an increase in the high category.

Hypothesis 5 test found out the effect of Adversity Quotient (X) on the mathematical creative thinking ability of students (Y) in Problem-Based Learning integrated STEM. The adversity quotient data was obtained from an Adversity Quotient questionnaire which acts as an independent variable and mathematical creative thinking abilities whose data was obtained from the final test of mathematical creative thinking abilities which acted as the dependent variable. In the output Coefficients the value of sig is obtained. $(\text{contstant}) = 0.004 < \alpha = 0.05$ and $sig.(\text{independence})\ 0.000 < \alpha = 0.05$, so H_0 is rejected. The regression equation for the two variables can be expressed in the following model where Y is mathematical creative thinking ability and X is Adversity Quotient, namely $Y = \alpha + \beta X = 22.383 + 0.456X$. The value of the coefficient of determination of adversity quotient on mathematical creative thinking ability is 0.673 (R square) or 67.3%. This means that the contribution of Adversity Quotient to variations in the ups and downs of mathematical creative thinking abilities is 67.3% and the remaining 32.7% is caused by other factors. Masitoh & Agoestanto (2020) shows that the average creative thinking ability of students' mathematical creative thinking is 68.6% influenced by interest in learning and AQ. Nurjanah et al. (2019)suggests that a person's success in developing creative thinking abilities can be influenced by internal factors and external factors. Based on the regression test, it shows that students' interest in learning and AQ have a positive effect on student learning success. As for Leonard & Amanah (2014) stated from the results of their research that there is a significant influence between Adversity Quotient (AQ) on mathematics learning achievement, which means that the better the adversity quotient of students, the better the students' achievement in learning mathematics.

3.3. Qualitative Data Analysis

In the qualitative data analysis of this study, data reduction, data presentation, and conclusions were drawn first. Data reduction begins with recording the results of the posttest, recording the adversity quotient level questionnaire, and determining the subjects to be interviewed. As a result of this reduction, there is a sub-chapter for determining research subjects. Data reduction was also carried out on the results of research subject interviews by simplifying the two results into a simple and neat arrangement of language regarding the ability to think creatively mathematically.

Based on the results of the adversity quotient questionnaire analysis of 33 class VIII-B students of SMP Negeri 1 Tayu, there were 7 students with a high level of adversity quotient, and 26 students with a moderate level of adversity quotient. According to Stoltz (2020) group experience in facing and overcoming challenges or difficulties can increase the AQ score of a group, in this case students in the experimental class who have the same experience in dealing with difficulties in learning enable them to have higher AQ scores even almost the same. In addition to group experiences, Stoltz (2020) also stated that a group environment that is challenging and provides opportunities for learning and development can help increase the group's AQ level. From these two factors, it is very possible for a group to have an AQ level of only the type of campers (medium AQ) and climbers (high AQ). The selection of research subjects was chosen by each of the three students in each level of the adversity quotient with the dominant level of creative thinking skills at each level of the adversity quotient. The selection of the subject was based on consideration of the level of adversity quotient, pretest results, and posttest results. The selected subjects were then interviewed.

Based on the analysis of the results of the questionnaire on the level of student interest in learning, six research subjects were selected which can be seen in the table 4.

Table 4. List of Research Subjects

No	Subject	Code	Category
1	S-1	B-19	Campers
2	S-2	B-03	Campers
3	S-3	B-08	Campers
4	S-4	B-32	Climbers
5	S-5	B-01	Climbers
6	S-6	B-16	Climbers

After selecting the research subject, the interview process was then carried out on the subject. From the interview process, technical training will then be carried out which compares the analysis of the results of the work and the analysis of the results of the interviews. Based on the results of the triangulation, a table of the results of the research subject's mathematical creative thinking abilities was then made for each indicator and as a whole.

Table 5. Results Mathematical Creative Thinking Ability of Research Subjects

AQ Category	Code	Indicator			
		Fluency	Flexibility	Originality	Elaboration
Campers	B-19	F	LF	LF	LF
	B-03	LF	F	LF	LF
	B-08	F	LF	F	LF
Climbers	B-32	F	LF	F	LF
	B-01	F	F	LF	F
	B-16	F	F	F	F

Description:
F : Fulfill
LF : Less fulfilling

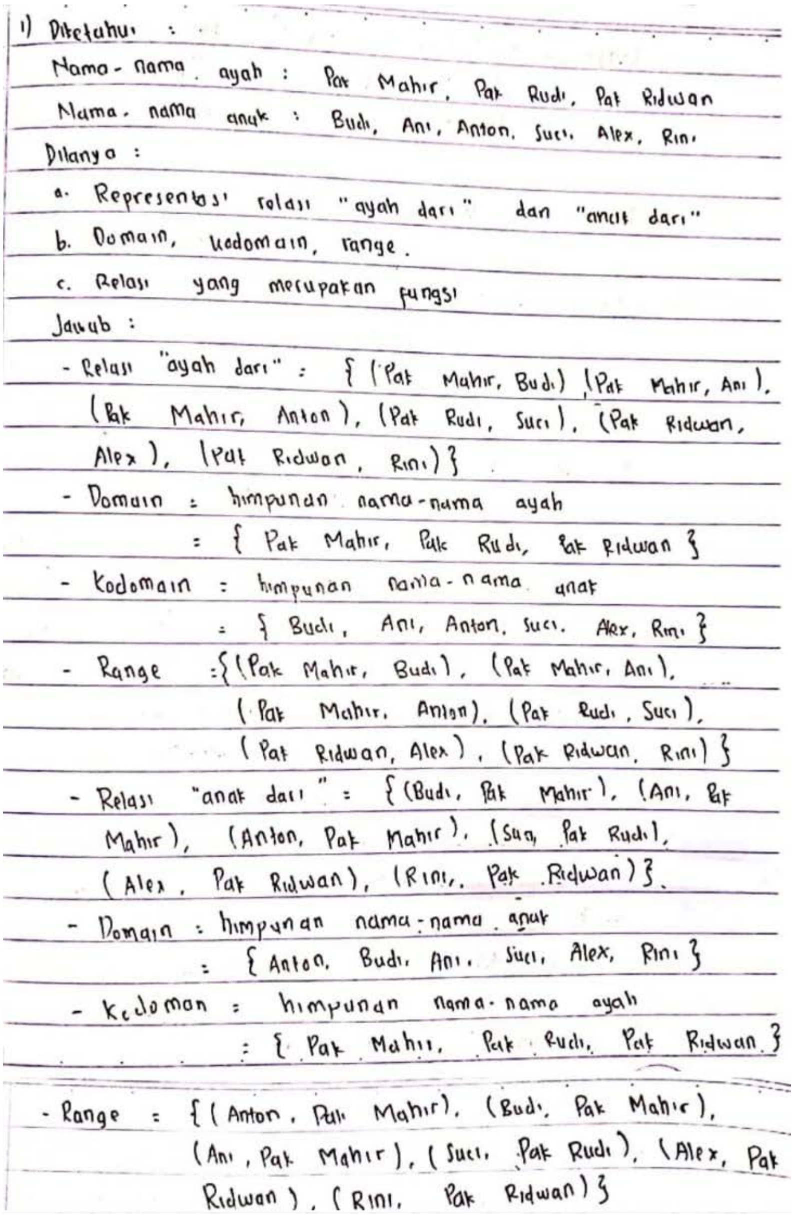
These results indicate that the ability to think creatively mathematically is related to students' AQ. This is because when students work on math problems, they must have self-confidence, persistence, determination, and not give up in the face of difficulties.

In the type of campers, there are three research subjects selected namely B-19, B-03 and B-08. Based on the results of the analysis, the subjects, namely B-19, B-03 and B-08, did not fulfill the four indicators of ability to think creatively mathematically. On the fluency indicator, students with a moderate level of adversity quotient tend to be able to write answers to problems fluently or fluently by writing down each process in full. On subject B-03 can provide the correct steps for completion but there are errors in writing answers. Meanwhile, based on the results of the B-19, B-03 and B-08 subject interviews, they confidently explained their ideas or answers during the test smoothly and correctly.

On the flexibility indicator, students with moderate adversity quotient tend to be able to solve questions. However, B-19 and B-08 tend to be able to solve questions correctly but have not been able to find various/flexible ways. Meanwhile, Master's degree tends to be able to solve questions in various/flexible ways but has not been able to provide the right answers. Meanwhile, based on the results of the B-19, B-03 and B-08 subject interviews, they tend to be able to explain back the ideas that have been obtained well.

On the originality indicator, students with a moderate level of adversity quotient tend to be able to solve questions. However, B-19 has not been able to provide solutions in a way that produces new ideas precisely. B-03 and B-08 tend to be able to provide solutions in a way that generates new ideas, but S-2 has not been able to produce the right answers while B-08 has been able to produce the right answers. Meanwhile, based on the results of interviews, subject B-19 can mention and explain the method used to solve the problem, but this method is not a new method, B-03 and B-08 can mention and explain the new method used to solve the problem.

On the elaboration indicator, students with a moderate level of adversity quotient tend to be able to develop and detail their ideas to find a solution to a given problem, but have not been able to provide the right answer. Meanwhile, based on the results of the interviews, they were able to re-explain the ideas that had been developed and detailed.



1) Diketahui :
Nama - nama ayah : Pak Mahir, Pak Rudi, Pak Ridwan
Nama - nama anak : Budi, Ani, Anton, Suci, Alex, Rini
Ditanya :
a. Representasi relasi "ayah dari" dan "anak dari"
b. Domain, kodomain, range.
c. Relasi yang merupakan fungsi
Jawab :
- Relasi "ayah dari" : {(Pak Mahir, Budi), (Pak Mahir, Ani), (Pak Mahir, Anton), (Pak Rudi, Suci), (Pak Ridwan, Alex), (Pak Ridwan, Rini)}
- Domain : himpunan nama-nama ayah
: {Pak Mahir, Pak Rudi, Pak Ridwan}
- Kodomain : himpunan nama-nama anak
: {Budi, Ani, Anton, Suci, Alex, Rini}
- Range : {(Pak Mahir, Budi), (Pak Mahir, Ani), (Pak Mahir, Anton), (Pak Rudi, Suci), (Pak Ridwan, Alex), (Pak Ridwan, Rini)}
- Relasi "anak dari" : {(Budi, Pak Mahir), (Ani, Pak Mahir), (Anton, Pak Mahir), (Suci, Pak Rudi), (Alex, Pak Ridwan), (Rini, Pak Ridwan)}
- Domain : himpunan nama-nama anak
: {Anton, Budi, Ani, Suci, Alex, Rini}
- Kodoman : himpunan nama-nama ayah
: {Pak Mahir, Pak Rudi, Pak Ridwan}
- Range : {(Anton, Pak Mahir), (Budi, Pak Mahir), (Ani, Pak Mahir), (Suci, Pak Rudi), (Alex, Pak Ridwan), (Rini, Pak Ridwan)}

Figure 1. example of average AQ student work category fluency.

In the climbers type, there are three research subjects selected, namely B-33, B-01, and B-16. Based on the results of the analysis, subjects namely B-33, B-01, and B-16 did not fulfill the four indicators of ability to think creatively mathematically. On the fluency indicator, students with a high level of adversity quotient tend to be able to master the B-33, B-01, and B-16 tend to be able to solve problems fluently by writing down each processing process completely and precisely. Meanwhile, based on the results of interviews with subjects B-33, B-01, and B-16, they confidently explained their ideas or answers during the test smoothly and correctly.

On the flexibility/flexibility indicator, students with a high level of adversity quotient tend to be able to solve questions in a variety/flexible way. However, B-33 has not been able to solve the problem in various/flexible ways. Meanwhile, based on the results of the B-33, B-01, and B-16 subject interviews, they tend to be able to explain back the ideas that have been obtained properly and correctly. In the interview, B-33 was able to provide other ideas for solving the problems in the questions.

On the originality indicator, students with a high level of adversity quotient tend to be able to solve questions. B-33 tends to be able to provide solutions in a way that is obtained from his own ideas precisely.

Whereas B-01 and B-16 tend to be able to provide solutions in a way that generates new ideas, B-01 has not been able to produce the right answers. As for the results of interviews with subjects B-33, B-01, and B-16 can mention and explain the method used to solve the problem, but the method used by B-33 is not a new method, B-01 and B-16 can mention and explain the new way used to solve the problem.

On the elaboration indicator, students with a high level of adversity quotient tend to be able to develop and detail their ideas to find a solution to a given problem. However, B-33 has not been able to provide a precise answer. For B-01 and B-16, they have been able to provide appropriate answers. Meanwhile, based on the results of the B-33, B-01, and B-16 interviews, they were able to re-explain the ideas that had been developed and detailed. In this section, the results of the analysis of adversity quotient and mathematical creative thinking ability will be presented in posttest of students mathematical creative thinking ability conducted by interview.

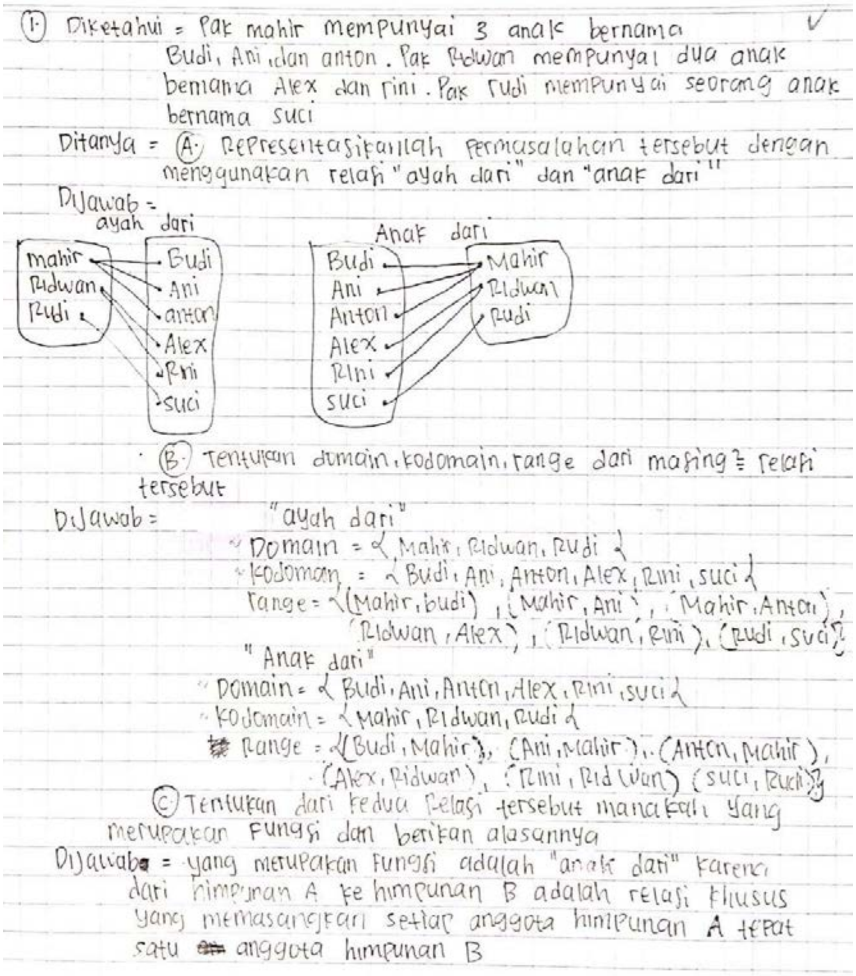

1. Diketahui = Pak mahir mempunyai 3 anak bernama Budi, Ani, dan anton. Pak Ridwan mempunyai dua anak bernama Alex dan rini. Pak rudi mempunyai seorang anak bernama suci
Ditanya = A. Representasikanlah permasalahan tersebut dengan menggunakan relasi "ayah dari" dan "anak dari"
Dijawab =
ayah dari
mahir, Ridwan, Rudi → Budi, Ani, anton, Alex, Rini, suci
Anak dari
Budi, Ani, Anton, Alex, Rini, suci → Mahir, Ridwan, Rudi
B. Tentukan domain, kodomain, range dari masing² relasi tersebut
Dijawab = "ayah dari"
Domain = {Mahir, Ridwan, Rudi}
kodomain = {Budi, Ani, Anton, Alex, Rini, suci}
range = {(Mahir, budi), (Mahir, Ani), (Mahir, Anton), (Ridwan, Alex), (Ridwan, Rini), (Rudi, Suci)}
"Anak dari"
Domain = {Budi, Ani, Anton, Alex, Rini, suci}
kodomain = {Mahir, Ridwan, Rudi}
Range = {(Budi, Mahir), (Ani, Mahir), (Anton, Mahir), (Alex, Ridwan), (Rini, Ridwan) (suci, Rudi)}
C. Tentukan dari kedua relasi tersebut manakah yang merupakan fungsi dan berikan alasannya
Dijawab = yang merupakan fungsi adalah "anak dari" karena dari himpunan A ke himpunan B adalah relasi khusus yang memasangkan setiap anggota himpunan A tepat satu anggota himpunan B

Figure 2. example of high AQ student work category fluency.

4. Conclusion

Based on the result and discussion of the study, the conclusion can be found as follows: (1) the average test results for students' mathematical creative thinking skills using the STEM-integrated Problem-Based Learning model reach mastery learning criteria; (2) the results of students' mathematical creative thinking ability tests using the STEM-integrated Problem-Based Learning model achieve classical mastery; (3) students' creative thinking abilities with STEM-integrated Problem-Based Learning models are better than students' creative thinking abilities with conventional learning models; (4) improving students' mathematical creative thinking abilities in the STEM integrated Problem-Based Learning model is better than increasing students' mathematical creative thinking abilities in conventional learning models; (5) there is an influence of the Adversity Quotient on students' mathematical creative thinking abilities in the STEM integrated Problem-Based Learning model; (6) S-1, S-2 and S-3 are not yet able to fulfill the four indicators of mathematical creative thinking ability; S-4 and S-5 are not yet able to fulfill the four indicators of mathematical creative thinking ability, and S-6 fulfills the four indicators of mathematical creative thinking ability.

References

Anditiasari, N., Pujiastuti, E., & Susilo, B. E. (2021). Systematic literature review : pengaruh motivasi terhadap kemampuan berpikir kreatif matematis siswa. *Aksioma: Jurnal Matematika Dan Pendidikan Matematika*, *12*(2), 236–248.

Dewi, W. I., & Harjono, N. (2021). Efektivitas Model Pembelajaran Problem Solving dan Problem Based Learning (PBL) Ditinjau dari Kemampuan Berpikir Kreatif Matematis Siswa Kelas 5 Sekolah Dasar. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *5*(3), 2678–2689. https://doi.org/10.31004/cendekia.v5i3.943

Florida, R., Mellander, C., & KIng, K. (2015). *The Global Creativity Indeks 2015*. 1–64.

Jauhariyyah, F. R., Suwono, H., & Ibrohim. (2017). Science, Technology, Engineering and Mathematics Project Based Learning (STEM-PjBL) pada Pembelajaran Sains. *Prosiding Seminar Pendidikan IPA Pascasarjana UM*, *2*, 432–436.

Leonard, & Amanah, N. (2014). Pengaruh Adversity Quotient (AQ) dan Kemampuan Berpikir Kritis terhadap Prestasi Belajar Matematika. *Perspektif Ilmu Pendidikan*, *28*(1), 55–64.

Mardhiyah, R. H., Aldriani, S. N. F., Chitta, F., & Zulfikar, M. R. (2021). Pentingnya Keterampilan Belajar di Abad 21 sebagai Tuntutan dalam Pengembangan Sumber Daya Manusia. *Jurnal Pendidikan*, *12*(1), 29–40. https://kns.cnki.net/kcms/detail/11.1991.n.20210906.1730.014.html

Masitoh, S., & Agoestanto, A. (2020). *Kemampuan Berpikir Kreatif Matematis Ditinjau dari Minat Belajar dan AQ Siswa Melalui Model Pembelajaran Creative Problem Solving*. *2008*.

Nurjanah, S., Sarah, S., & Zanthy, L. S. (2019). Analisis Kemampuan Berpikir Kreatif Matematis Dan Minat Belajar Siswa MTS. *Journal on Education*, *1*(3), 260–266.

PISA, O. (2019). PISA 2018 Assessment and Analytical Framework. In *OECD Publishing*. https://doi.org/10.1787/b25efab8-en

Rahmah, N. (2018). Hakikat Pendidikan Matematika. *Al-Khwarizmi: Jurnal Pendidikan Matematika Dan Ilmu Pengetahuan Alam*, *1*(2), 1–10. https://doi.org/10.24256/jpmipa.v1i2.88

Rizqi, M., Suyitno, H., & Dwijanto. (2019). *Efektivitas pembelajaran berbasis masalah dalam meningkatkan kemampuan berpikir kreatif matematis siswa mts islamic center cirebon*. 300–305.

Sari, D. N. K., & Masrukan. (2022). Penerapan Asesmen Berbasis Socrative untuk Mengukur Kemampuan Berpikir Kreatif Matematis dengan Model Problem Based Learning Ditinjau dari Rasa Ingin Tahu. *UJME*.

Sumartini, T. S. (2019). Kemampuan Berpikir Kreatif Mahasiswa melalui Pembelajaran Mood , Understanding , Recall , Detect , Elaborate , and Review Mosharafa : Jurnal Pendidikan Matematika Mosharafa : Jurnal Pendidikan Matematika. *Mosharafa: Jurnal Pendidikan Matematika*, *8*(1), 13–24.

Vistara, M. F., Asikin, M., Ardiansyah, A. S., & Pudjiastut, E. (2022). Problem Based Learning Berorientasi STEM Context terhadap Kemampuan Berpikir Kreatif Matematika Siswa. *Prosiding Seminar Nasional Matematika (PRISMA)*, *5*, 451–460. https://journal.unnes.ac.id/sju/index.php/prisma/article/view/54564

Widi Trisna Putri, M., & Ratu, N. (2018). Analisis Tingkat Berpikir Kreatif Siswa Dalam Menyelesaikan Soal Luas Gabungan Pada Materi Bangun Datar Di Smp Negeri 8 Salatiga Kelas Vii. *Pendekar : Jurnal Pendidikan Berkarakter*, *1*(1), 103. https://doi.org/10.31764/pendekar.v1i1.298

Widowati, C., Purwanto, A., & Akbar, Z. (2021). Problem-Based Learning Integration in Stem Education to Improve Environmental Literation. *International Journal of Multicultural and Multireligious Understanding*, *8*(7), 374. https://doi.org/10.18415/ijmmu.v8i7.2836

Winoto, Y. C., & Prasetyo, T. (2020). Efektivitas Model Pembelajaran Problem Solving dan Discovery Learning Terhadap Kemampuan Berpikir Kritis Siswa Sekolah Dasar. *Jurnal Basicedu*, *4*(2), 361–370. https://doi.org/10.31004/basicedu.v4i2.358