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MATHEMATICS CONNECTION VIEWED FROM ADVERSITY QUOTIENT IN LMS ASSISTED PROBLEM BASED LEARNING IN SMA

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ABSTRACT

The connection between mathematics and adversity quotient (AQ) is vital in a person's ability to make decisions to solve problems in life. The problem-based learning (PBL) model, assisted by the learning management system (LMS), utilizes technology combining PBL models and LMS-assisted learning. This study aims to (1) examine the effectiveness of LMS-assisted PBL in improving high school students' mathematical connection skills and (2) examine the effect of AQ on students' mathematical connection abilities in LMS-assisted PBL learning. This type of research is a mixed-method research with a sequential explanatory design with a more significant quantitative portion than the qualitative one. The population of this study was class XI students of SMA N 1 Ungaran, Semarang Regency. The research sample was taken using a simple random sampling technique. Qualitative data was taken based on the students' AQ. Quantitative data analysis techniques with parametric statistics include average, classical completeness, and regression tests—qualitative data analysis techniques using data reduction, presentation, and conclusion. The results showed that (1) LMS-assisted PBL learning was effective in increasing students' mathematical connections, and (2) AQ had an influence on students' mathematical connection abilities in LMS-assisted PBL learning.

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1. INTRODUCTION

One goal The State of Indonesia which is listed in the Preamble of the 1945 Constitution is to educate the life of the nation. This goal can be achieved through education which is an important factor for the progress of a nation. Education according to Law No.

20 of 2013 National Education System is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by himself, society, nation and state.

Mathematics is one of the sciences that can help in solving problems. Learning mathematics involves developing strong schemata, which itself requires students to connect related ideas. Students' mathematical connection abilities need to be developed through learning models. The selection of the learning model used must be in accordance with the conditions(Syaiful et al., 2021). The learning model greatly influences the process and learning outcomes(Brinus et al., 2019; Cahyaningrum et al., 2019). PBL is one of the learning models that can facilitate students' mathematical connection skills(Juniati J et al., 2021). Therefore, this study uses the PBL model because it is more flexible when it is applied.

Post-pandemic conditions have changed the way of learning in schools. Many learning activities are now using online and offline. This is a challenge for teachers to plan, implement and evaluate learning. This resulted in learning to continue to utilize communication technology.

Communication technologies such as mobile phones have developed into multifunctional smartphones. The facilities or features provided by smartphones are many and unlimited, such as games, email, social media, learning media, and many more. However, the development of smartphone applications has not been properly addressed by students. The benefits of using smartphones have not been maximized in the world of student education. Smartphones are used more for social media, games both offline and online, and several other applications that do not support student education. The use of smartphones is expected to be more useful in the learning process.

The use of information technology can be implemented in learning to achieve learning objectives more easily and effectively for students. According to Yohannes et al., (2016), learning to use information technology in multimedia is more effective than learning using conventional methods. Learning to use information technology will provide maximum benefits to students in accordance with the times in the era of high use of information technology using the internet(Wardono et al., 2018).

Learning systems that utilize information technology are known as e-learning One learning platform that is widely used by schools in Indonesia is Moodle. The advantage of Moodle is that this application can be used freely as open source, can be accessed for free, teachers can enter teaching materials, assignments, quizzes, and even the results of the exams given. This agrees with(Handayanto et al., 2018), Moodle-based learning can increase student interest, participation, and learning outcomes.

The ability to endure adversity, known as the Adversity Quotient (AQ), is an important aspect of a person's quality of life. AQ can provide a strong motivation for a person to solve the problem at hand, thus supporting the achievement of success(Suryaningrum et al., 2020). Stoltz grouped individuals based on their fighting power into three, namely quitter, camper, and climber. Quitters are people who give up easily, campers are people who feel satisfied with certain achievements, and climbers are people who constantly want to achieve success.

In In fact, research shows that students' mathematical connection skills are low. Research by (Hanarafa & S, 2021; Hati et al., 2022; Kenedi et al., 2019). found that the level of mathematical connection ability of learners is low.

Based on the description above, this study will examine the connection of mathematics to problem-based learning assisted Learning Management System (LMS) in high school.

2. METHOD

This research uses a combination of qualitative and quantitative research (mix methods). The method used is sequential explanatory design, namely this strategy is applied to the collection and analysis of quantitative data in the first stage, followed by the collection and analysis of qualitative data in the second stage, which is built based on the initial quantitative results, where more weight/priority is given to quantitative data (Creswell: 2014)

The population of this study was all grade XI students of SMA N 1 Ungaran, Semarang Regency. The sample of this study consisted of 64 class XI social studies students who had taken trigonometry subjects. Research samples taken using simple random sampling techniques are used for sampling. Class XI IPS 2 (Control class) and class XI IPS 1 (Experimental class) are classes used for research. While qualitative data is taken based on students' AQ, namely climber, camper, and quitter categories. In this study, the independent variable is Adversity Quotienty when using the LMS-assisted problem-based learning paradigm. While mathematical connections are the dependent variable in this study. The research instruments used include the Adversity Quotienty questionnaire and mathematical connection test questions.. Quantitative data analysis techniques in this study used average tests, classical due diligence, and regression tests. Qualitative data analysis techniques use data reduction, presentation, and conclusions.

This questionnaire was used to measure the level of Adversity Quotienty (AQ) where in this study there were 3 categories, namely quitters, campers, and climbers. This is described in the following table (Mafulah & Amin, 2020):

Table 1. Indicator AQ

Score	AQ Level Categories
<59	Quitters
60-94	Switching quitters (QT) to campers (CP)
95-134	campers
135-165	Transition of campers (CP) to climbers (CB)
>165	Climber

In addition, to measure the mathematical connection test in this study using several tests, including:

1) Normality test
2) Homogeneity test
3) Average difference test using the t test.
4) Classical Due Diligence

Classical completeness testing is used to determine whether the percentage of students in LMS-assisted problem-based learning who achieve individual completeness reaches 75%. The statistical hypothesis is as follows.

H_0: $\pi \leq 75\%$ (The proportion of mathematical connection skills of students taught with LMS-assisted problem-based learning that achieve completeness has not reached at least 75%).

H_1: $\pi > 75\%$ (The proportion of mathematical connection skills of students taught with LMS-assisted problem-based learning that achieve completeness has reached at least 75%).

The test criterion is H_0 is accepted if the Zcalculate value is $\leq Z(0{,}5-\alpha)$. The formula used is as follows :

$$z = \frac{\frac{x}{n} - \pi_0}{\sqrt{\frac{\pi_0(1-\pi_0)}{n}}}$$

Information :
z : Calculated z-value
x : the number of students who complete individually
π_0 : hypothesized value
n : number of sample members

3. RESULTS AND DISCUSSION

The results of research on mathematical connections in terms of AQ of students in LMS-assisted PBL, namely the quantitative stage and the qualitative stage which aim to answer the problem formulation. The quantitative stage in this study will describe the results of the average student analysis, classical completeness, and the influence of students' AQ on mathematical connections. The results of the analysis of this quantitative stage aims to test the hypotheses in this study. Before carrying out several tests related to the hypothesis, the normality and homogeneity tests are carried out first.

3.1. Quantitative Data Analysis

Before testing the data into the normality test, the descriptive table will be presented first, which is as follows:

Table 2. Descriptive Statistical Test Results

Descriptive Statistics					
Statistic	N	Minimum	Maximum	Mean	Std. Deviation
Pretest_Eks	32	24	65	47.78	11.714
Posttest_Eks	32	24	82	57.44	14.402
Pretest_Kontrol	32	24	53	35.16	10.445
Posttest_Kontrol	32	18	76	46.81	15.192
Valid N	32				

In table 2 above, it can be seen that the experimental class pretest and posttest variables have the lowest value of 24 and the highest value of 82 with their average values of 47.78 and 57.44 and their standard deviations (data distribution rates) of 11.714 and 14.402. The control class pretest and posttest variables had the lowest values of 18 and 24 while the highest values were 53 and 76 with average values of 35.16 and 46.81.

3.1.1. Normality test

Table 3. Data Normality Test Results

Class	Sig.	Information
Eksperimen	0,200	Normal distributed data
Control	0,200	Normal distributed data

Based on the table above, the sig values of the two classes are 0.200 and 0.200 so that the sig values of the two classes are more than 5%, then H_0 is accepted, meaning that the final data comes from a normally distributed population. So, the sample comes from a normally distributed population sig value

3.1.2. Homogeneity test

Table 4. Data Homogeneity Test Results

		Levene Statistic	df1	df2	Sig.
Score	Based on Mean	2.626	1	62	.110
Test	Based on Median	2.636	1	62	.110
	Based on Median and with adjusted df	2.636	1	59.354	.110
	Based on trimmed mean	2.700	1	62	.105

Based on the table above, sig values of 0.110, 0.110, 0.110 and 0.105> 0.05 are obtained. Since the sig value is more than 5% then H0 is accepted, this indicates that the variance of the experimental class is equal to the variance of the control class.

3.1.3. Hypothesis Test 1 (Test of Average Mathematical Connection Ability)

Table 5 Average Test Results for Mathematical Connection Ability

	N	Mean	Std. Deviation	t	Sig.(2-tailed)
TKKM_Eks	32	.6889	.22306	8.200	0.000
TKKM_Kontrol	32	.1520	.29574	8.200	0.000

Based on the results calculation with formula t,earned value t_{hitung} = 8,200> 1.746 = t_{tabel} then H_0 is rejected. That is, the average mathematical connection ability of students given LMS-assisted problem-based learning is better or equal to the average mathematical connection ability given problem-based learning.

3.1.4. Hypothesis Test 2 (Classical Completeness of Mathematical Connection Ability)

Table 6. Results of the Experiment Class Classical Completeness Test

Class	X	n	π_0	z_{count}	$z_{(0,5-\alpha)}$	Criteria	Results
Eks	30	32	0,75	2,467	0,1736	$z_{hitung} > z_{tabel}$	H_0 rejected
Control	25	32	0,75	4,111	0,1736	$z_{hitung} > z_{tabel}$	H_0 rejected

Based on table 6, the z_{hitung} value in the experimental class was 2.467 > 0.196 and in the control class the z_{tabel} value was 4.111, then **H_0** was rejected. That is, more than 75% of

the final test results of students' mathematical connection abilities in LMS-assisted Problem-based learning are declared complete and achieve classical completeness.

3.2 Subject Determination Based on AQ

Subject determination based on AQ is divided into three categories, namely climber, camper, and quitter. The grouping of participants based on AQ was carried out before and during the implementation of the learning process. The data used in determining this subject is from the results of the AQ questionnaire. The grouping of subjects and the percentage of students based on the AQ questionnaire can be seen in table 7.

Table 7. Grouping of Subjects and Percentage of Students Based on the AQ Questionnaire

Category	Many Students	Percentage (%)
Climbers	4	22%
Campers	10	56%
Quitters	4	22%
Amount	18	100%

Based on the grouping of subjects from the results of the AQ questionnaire, two subjects from each category were selected to be interviewed regarding students' mathematical connection abilities. This aims to clarify the existence of a relationship between AQ and students' mathematical connection abilities. Sampling from each level of student AQ was carried out using a proportionate stratified random sampling technique, namely taking samples of data sources based on proportions. The selection of the sample was based on certain characteristics that were considered to have something to do with the population characteristics that were previously known and based on the recommendations from the class XI IPS teacher.

3.2.1 Mathematical Connection Ability with AQ Climber

Students who have AQ climber categories are 9 (nine) students, namely A17, A2, A15, A22, A12, A20, A24, A16, and A10. The percentage of students who have AQ climber category is 80.22% of the total number of experimental class students. The results of the learners' math connection ability test are shown in table 8.

Table 8. Test Results of Students' Mathematical Connection Ability with AQ Climber

No	Code	Adversity Quotient Score	TKKM score
1	A17	161	80
2	A2	155	79
3	A16	149	81
4	A10	148	79
5	A22	157	82
6	A12	154	81
7	A20	151	78
8	A24	153	80
9	A15	149	82
Average		**153**	**80,22**

Based on table 7 it can be seen that learners with AQ climber scores have quite high mathematical connection abilities, namely 78 to 82 with an average of 80.22. This means that the ability of students' mathematical connections with AQ climbers has reached completion.

3.2.2 Mathematical Connection Ability with AQ Camper

Students who have AQ climber category as many as 17 students namely A1, A3, A5, A7, A9, A11, A13, A18, A19, A21, A23, A26, A27, A28, A29, A30, and A31 with the percentage of students who have AQ climber category is 53.125% of the total number of experimental class students. The results of the learners' math connection ability test are shown in the table 9.

Table 9 Test Results of Students' Mathematical Connection Ability with AQ Camper

No	Code	Adversity Quotient Score	TKKM score
1	A1	95	69
2	A3	97	68
3	A5	95	70
4	A7	96	68
5	A9	101	68
6	A11	102	70
7	A13	98	65
8	A18	97	67
9	A19	96	69
10	A21	99	67
11	A23	105	69
12	A26	110	72
13	A27	102	70
14	A28	108	65
15	A29	115	70
16	A30	130	68
17	A31	125	70
Average		**1771**	**68,52**

Based on the table, it can be seen that learners with AQ camper scores have sufficient mathematical connection abilities, namely 65 to 72 with an average of 68.52. This means that students with AQ Camper are able to complete the math connection ability test well, but campers students do not re-examine the completion that has been obtained because they are satisfied with the results.

3.2.3 Mathematical Connection Ability with AQ Quitter

Students who have AQ climber categories are 6 (nine) students, namely A4, A6, A8, A14, A25, and A32. The percentage of students who have the AQ Quitter category is 18.75% of the total number of experimental class students. The results of the learners' math connection ability test are shown in the table 10.

Table 10 Test Results of Students' Mathematical Connection Ability with AQ Quitter

No	Code	Adversity Quotient Score	TKKM score
1	A4	45	40
2	A6	40	56
3	A8	48	59
4	A14	58	48
5	A25	55	50
6	A32	50	52
Average		**296**	**50,83**

Based on the table 10, it can be seen that students with AQ camper scores have sufficient mathematical connection abilities, namely 40 to 58 with an average tkkm score of 50.83. This means that students with AQ Camper are able to complete math connection ability tests well but quitter students cannot solve problems with correct answers..

3.3. Qualitative Data Analysis

In this study, connection ability was described based on the AQ category, namely climber, camper, quitter on four components of mathematical connections, namely connections in the same material, connections between topics in mathematics, connections between subjects, and connections with the real world. There are 9 students belonging to the AQ climber category, 17 students belonging to the AQ camper category, and 6 students belonging to the AQ quitter category. The climber and quitter categories were taken by 2 students, while the camper was taken by 2 students who were selected as qualitative research subjects to describe their connection abilities.

In general, learners belonging to the AQ climber group have excellent mathematical connection skills. Learners with an AQ climber can master the four components of mathematical connections very well. In addition, climbers have relatively high scores on aspects of control, origin & ownership, reach and endurance. Because they have a good control score, students increasingly master the situation when facing problems

Furthermore, students who belong to the AQ Camper group can solve problems with the right answers. However, they did not re-examine the settlement that had been obtained because they were satisfied with the results. This can cause them not to realize any errors in the resolution. Learners with AQ Camper have sufficient ability to solve problems. However, they have high self-confidence and tend to feel satisfied with the results they have achieved. This can cause them to be unmotivated to continue learning and improving their abilities.

On the other hand, learners with AQ Quitter cannot solve problems with the right answers. This can be caused by several factors, such as lack of understanding of the material, lack of critical thinking skills, or lack of motivation. Learners with AQ Quitter tend to give up easily when faced with challenges. They also have low self-confidence and tend to blame conditions or others for their failures.

Based on the description above, it shows that in solving mathematical problems, each subject who has high AQ levels (climbers), medium (campers), and low (quitters) has different mathematical connection abilities. This is in line with Irianti (2017) in a research she conducted that each of the three levels of AQ has its own characteristics in solving a problem. It is influenced by the character of the students for each level. Yoga (2016) distinguishes the personalities of climbers, campers, and quitters in his book. This character then affects the mathematical connection ability of each student in solving problems. Based

on this discussion, it can also be seen that the level of Adversity Quotient (AQ) owned by students affects students' mathematical connection ability in solving mathematical problems.

3.4. Quantitative anf Qualitative

Gunawan, (2011) states that the quality of a learning product is inseparable from the quality of the learning program and the learning process itself. In improving the quality of learning, the role of the teacher becomes important. The quality of learning in this study was reviewed quantitatively and qualitatively. A good learning program is of course inseparable from good learning tools. It is supported byRahmadi, (2015) which states that a learning device is said to be valid if it is at least in the good category so that the device is suitable for use.

At the assessment stage the researcher gave a test of students' mathematical connection abilities and an AQ questionnaire. At the assessment stage, the researcher also analyzed the test results of students' mathematical connection abilities. The researcher gave an initial mathematical connection ability test. The results of the initial mathematical connection ability test showed that the average mathematical connection ability of the experimental and control class students in solving math connection ability questions was almost the same. Based on the homogeneity test, information was obtained that the two classes had a homogeneous variance. Based on the average similarity test, it was concluded that the average test ability of the experimental and control class students in solving problems was not significantly different.

After the experimental class was given LMS-assisted PBL learning, it was followed by giving a math connection ability test. Then the TKKM results in the experimental class were tested for completeness. Students who were taught using LMS-assisted PBL on average completed KKM, the classical completeness test showed that the proportion of experimental class students who scored a minimum of 65 had exceeded 75%. Besides that, based on a review from AQ, AQ climbers have the best connection skills in the LMS-assisted problem-based learning model in high school.

4. CONCLUSION

Based on the results of the analysis of the results and discussion, the research conducted quantitatively and qualitatively is mutually reinforcing. Therefore, the conclusions of this study are:

a. LMS-assisted PBL learning is effective in increasing students' mathematical connections because:
   1) The mathematical connection abilities of students who receive problem-based learning assisted by the LMS average exceed the Minimum Completeness Criteria (KKM).
   2) The mathematical connection abilities of students who receive LMS-assisted problem-based learning can achieve classical mastery.
b. There is a significant effect of students' AQ on the ability of mathematical connections in LMS-assisted problem-based learning.

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