The influence of adversity quotient on students’ mathematical understanding ability

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Abstract. The objective of this article is to describe the influence of Adversity Quotient (AQ) on mathematical understanding ability from students’ who is a candidate for the math teacher. The study was correlational research in the form of experiments. Population in this research is mathematics teacher candidate residing in Cimahi City, West Java, Indonesia, while samples are 55 mathematics teacher candidate specified purposively then determined randomly. The results of this research show that AQ gives positive influence to students’ mathematical understanding ability with the coefficient of determination equal to 51.4%.

1. Introduction
The mathematical understanding ability can form a person’s mindset in solving problems at hand as mathematics is a scientific discipline capable to solve problems by using problem-solving practical analysis method [1,2]. It can be interpreted that someone possessing good mathematical understanding ability could acknowledge facts and solve a problem using diverse method [3,4].

Mathematical understanding ability is an important skill to math teachers. Nevertheless, there are existing mathematics teachers with a degree in mathematics who do not possess good mathematical conceptual understanding. This may cause a less optimal impact on students who are required to have mathematical understanding skills [5,6].

In addition to mathematical understanding, a person's attitude factors affect one's success in solving mathematics problems. This attitude factor is called Adversity Quotient (AQ) which is capable to align one's attitude and behaviour in solving mathematics problems [3,7].

AQ is a person’s ability in facing difficulties. A lot of people surrender in the face of problems due to difficulty level in problem-solving. It could be interpreted that AQ is a predictor of one's success in the face of adversity [8].

There are three types of AQ which are Quitter (Low AQ), Champer (Middle AQ), and Climber (High AQ). Someone possessing Climber AQ will easily face the difficulties experienced. While someone who Quitter AQ will encounter difficulties in problem-solving [9–11].

Students possessing Quitter AQ possess a tendency to have difficulty in solving mathematics problems as the students are accustomed to learning using completion algorithm guided by teachers. It is conducted using direct learning method which is less innovative. Therefore their mathematical understanding ability is limited to solving routine problems [6,11–13].
Based on the described issue, it is necessary to study in depth regarding the relationship and influence of mathematics teacher candidate AQ toward the achievement of mathematical understanding ability. Therefore the purpose of this research is to determine and study in depth regarding the influence of teacher candidate (university students) AQ to the achievement of mathematical understanding ability.

2. Experimental method
This study is a correlational research that aims to examine and study in depth regarding the influence of mathematics teacher candidate AQ to the achievement of mathematical understanding ability. Population in this research is mathematics teacher candidate residing in Cimahi City, West Java, Indonesia. Samples taken were 55 prospective teachers selected purposively. Instruments used were tests and non-tests. The test instrument is based on the assessment of good characteristics on students' mathematical understanding. The non-test instrument is based on the assessment of good characteristics on AQ. Research result data is processed and analyzed using regression test. However, before regression test, data normality and linearity test were conducted.

The Test and non-test instruments samples are presented in figures 1 and 2 below.

Function graphic \( f(x) \) is given below:

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a) Suppose, the graphic displayed is the one from \( f(x) \). Can the graphic be used for determining critical points, maximum & minimum local, maksimum & minimum absolute from \( f(x) \)? Give the reasons.
b) Suppose, the graphic displayed is the one from \( f'(x) \), first derivative \( f \). Can the graphic be used for determining critical points, maximum & minimum local, maksimum & minimum absolute from \( f(x) \)? Give the reasons.
c) Suppose, the graphic displayed is the one from \( f''(x) \), second derivative \( f \). Can the graphic be used for determining critical points, maximum & minimum local, maksimum & minimum absolute from \( f(x) \)? Give the reasons.
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**Figure 1.** Test instrument on students’ mathematical understanding ability.

**ADVERSITY QUOTIENT SCALE**
Students' ability to control an event related to the difficulties they encounter in learning can lead to future difficulties.

| No | Statement                                                                 | Strongly Agree | Agree | Disagree | Strongly Disagree |
|----|---------------------------------------------------------------------------|----------------|-------|----------|------------------|
| 1  | I realize that not all math problems are as difficult as I imagine        |                |       |          |                  |
| 2  | Mathematics challenges me to solve problems                               |                |       |          |                  |
| 3  | When receiving mathematics items, I feel not happy, my heart beats faster, I’m nervous |                |       |          |                  |

**Figure 2.** Non-test instrument on students adversity quotient.
3. Result and Discussion

Based on data analysis result, two variables namely AQ and students' mathematical understanding ability were normally distributed. Furthermore, the linearity test of students' mathematical understanding against AQ test result is presented in Table 1 below.

**Table 1.** Linearity test between AQ and mathematical understanding.

| Mathematical Understanding Ability | Sum of Squares | df | Mean Square | F        | Sig.   |
|-----------------------------------|----------------|----|-------------|----------|--------|
| Between Groups                    | (Combined)     | 32 | .997        | 2.029    | .043   |
| Linearity                         | 21.979         | 1  | 21.979      | 44.721   | .000   |
| Deviation from Linearity          | 9.936          | 31 | .321        | .652     | .866   |
| Within Groups                     | 10.813         | 22 | .491        |          |        |
| Total                             | 42.727         | 54 |             |          |        |

Based on the results of linearity test between AQ and students' mathematical understanding ability, Sig value in "Deviation from Linearity" obtained 0.866 value. It indicates existing linear relationship between AQ and students' mathematical understanding ability. In addition, the linearity level between AQ and students' mathematical understanding ability is quite strong (Sig = 0.000). Therefore regression test could proceed. Regression test results are presented in Table 2 and Table 3 below.

**Table 2.** Regression test between AQ and mathematical understanding ability.

| Model     | Sum of Squares | df | Mean Square | F        | Sig.   |
|-----------|----------------|----|-------------|----------|--------|
| Regression| 21.979         | 1  | 21.979      | 56.145   | .000b  |
| Residual  | 20.748         | 53 | .391        |          |        |
| Total     | 42.727         | 54 |             |          |        |

a. Dependent Variable: Mathematical Understanding Ability  
b. Predictors: (Constant), Adversity Quotient Score

**Table 3.** Regression test between AQ and mathematical understanding ability.

| Model | R      | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|--------|----------|-------------------|---------------------------|
| 1     | .717a  | .514     | .505              | .62568                    |

a. Predictors: (Constant), Adversity Quotient Score

Based on the regression test, Sig value 0.000 indicated that AQ had a significant influence on students' mathematical understanding at 5% significance level (Table 2). In addition, the magnitude of the correlation coefficient is 0.717 with the coefficient of determination on AQ to the students' mathematical understanding ability at 0.514. This resulted in the influence magnitude of AQ on students' mathematical understanding ability at 51.4% while the rest (48.6%) is influenced by other factors outside AQ.

Research result exhibited AQ possess a significant effect on the achievement of students' mathematical understanding ability. The results are in line with Leonard & Amanah [14] which states that AQ gives a positive influence on mathematics learning achievement. Oliveros [15] argued that AQ has a relationship to the process of solving mathematics problems. It is caused by reach factor which is one of the AQ indicators which is the most efficient predictor in solving one's problems [12].

The students with AQ Quitter appear to have difficulties in solving problems. This is seen from the answers given by them which do not display a good understanding process. The results of the work with the Quitter AQ are presented in Figure 3 below.
Based on Figure 3, it appears that the students with AQ Quitter still have difficulty in understanding the concept of maximum, minimum by using the second derivative. The students provide an argument for answers containing data, claims, guarantees, and disclaimers. The claims and guarantees presented are false. In addition, the disclaim is contradictory to the guarantee provided. Thus, it can be stated that the individual with AQ Quitter is still classified into the category of low in the ability to argue based on a reasoning process that impacts on the ability to mathematically argue [8,11,14,16–20].

4. Conclusion
Based on results and discussion, it can be concluded that AQ gives a positive influence prospective teacher (university students) mathematical understanding skills achievement. The determination coefficient of AQ influence on the achievement of students understanding ability is 51.4%. The rest (48.6) is influenced by other factors outside AQ. Based on these results, it can also be stated that the higher a person’s AQ level, the higher mathematical understanding ability achievement would be.

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