The adversity quotient and mathematical understanding ability of pre-service mathematics teacher

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Abstract. The Mathematical understanding has been studied before, but no research has a focus on mathematical understanding and adversity quotient (AQ) of the pre-service mathematics teacher. This study is experimental research that aims to know about the influence of AQ of pre-service mathematics teacher toward the achievement of mathematical understanding ability. The population of this study is the pre-service mathematics teacher in Cimahi City, West Java, Indonesia; while the sample is 55 pre-service mathematics teachers selected purposively. The results show that: (1) AQ gives positive influence to the development of mathematical understanding ability of pre-service mathematics teacher with the influence of 57.3%, while the rest of it (42.7%) is influenced by other factors outside AQ; (2) there are differences in achievement in mathematical understanding ability of pre-service mathematics teacher based on AQ level (climber, camper, quitter).

1. Introduction
The ability of mathematical understanding needs developing for mathematics student teachers. This is because a math teacher needs to have the ability to understand in solving various problems in mathematics learning. Should mathematics teacher do not have the ability to understand in mathematics, it can be predicted that students will also find it difficult to comprehend mathematics [1–4].

Knowledge factors from educators regarding subject matter knowledge and pedagogical content knowledge need considering to design learning so that students can develop mathematical understanding skills to be good [5]. Thus the development of learning mathematics in schools can be measured by the ability of teachers' mathematical understanding [1–4,6]. Ball et al. [6] stated that mathematics teachers must be able to connect interrelated concepts being given to students. But Bardini, Pierce, Vincent, & King [7] found that some mathematicians had mastered skills without their conceptual understanding.

Currently, mathematics teachers in Indonesia have demonstrated good mathematical understanding skills. However, based on the findings of other studies, it shows that the level of mathematical comprehension ability possessed by mathematics student teachers is still in the moderate category [8,9].

The results of the study related to the ability of students' mathematical understanding influenced by the learning approach and their initial mathematical ability factors showed less optimal results. This is in line with the findings of Hidayat & Aripin [8] stating that there is no interaction effect between learning approaches and students' initial mathematical abilities towards achieving mathematical comprehension skills.
In addition to the learning approach, students’ attitudinal factors determine the success of achieving mathematical abilities. One of these attitudes is Adversity Quotient (AQ) which is the fighting spirit of students in solving problems that are being faced [2,10].

There are three levels in AQ, namely Climber, Camper, and Quitter. Someone with AQ Climber is someone who can solve problems even though they are under pressure. They choose to survive and struggle to face obstacles that can get the maximum solution. Someone with AQ Camper is an individual who is reluctant to take too high a risk and is satisfied with the results of the achievements that have been achieved even though they are not maximal. Someone with AQ camper tends to have a semi-conceptual thinking process in solving mathematical problems [11–13]. A person with AQ type quitter is someone who quickly gives up to despair without a problem-solving effort process because he or she thinks mathematics is difficult and complicated [11,13,14].

Based on those problems above, a comprehensive study of the role of AQ in the ability of mathematical understanding of student teacher is needed. Thus the purpose of this research is to know and examine in depth about the influence of pre-service mathematics teacher toward the achievement of mathematical understanding ability.

2. Method
This study is experimental with the population is the pre-service mathematics teacher in Cimahi City, West Java, Indonesia; while the sample is 55 pre-service mathematics teachers selected purposively. The data were analyzed by using One-Way ANNOVA test to see the difference between AQ Level (Climber, Camper, and Quitter) and achievement and improvement students’ mathematical understanding ability.

The AQ grouping criteria are presented in Table 1.

| AQ Score                      | Category   |
|-------------------------------|------------|
| AQ ≥ x + DS                  | Climber    |
| x – DS < AQ < x + DS         | Camper     |
| AQ ≤ x –DS                   | Quitter    |

3. Result and Discussion
Based on the result of research, the variables 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 2.

| Sum of Squares | df | Mean Square | F      | Sig. |
|----------------|----|-------------|--------|------|
| **Between Groups (Combined)** | 144.959 | 27 | 5.369 | 3.391 | 0.001 |
| **Linearity** | 108.288 | 1 | 108.288 | 68.392 | 0.000 |
| **Deviation from Linearity** | 36.671 | 26 | 1.410 | .891 | 0.615 |
| **Within Groups** | 42.750 | 27 | 1.583 | | |
| **Total** | 187.709 | 54 | | | |

The results of the linearity test between AQ and students' mathematical comprehension abilities, showed a linear relationship (Deviation from linearity = 0.615) with a fairly strong level of linearity (Sig = 0.000). The regression test is then carried out with the results presented in Table 3 and 4.
Table 3. The test of regression between AQ and understanding ability

| Model        | Sum of Squares | df | Mean Square | F      | Sig. |
|--------------|---------------|----|-------------|--------|------|
| 1 Regression | 108.288       | 1  | 108.288     | 72.263 | 0.000 |
| Residual     | 79.421        | 53 | 1.499       |        |      |
| Total        | 187.709       | 54 |             |        |      |

Table 4. Summary of regression test between AQ and understanding ability

| Model | R  | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|----|----------|-------------------|---------------------------|
| 1     | 0.760ₐ | .577     | .569              | 1.22414                   |

Based on the regression test, it can be concluded that there is a significant effect of AQ on students' mathematical understanding ability with a determination coefficient value of 0.577. It can be said that the magnitude of the influence of AQ on students' mathematical comprehension ability is 57.7% while the rest (42.3%) is influenced by factors other than AQ.

And then to find out the differences from each level of AQ (Climber, Camper, and Quitter) to mathematical comprehension abilities is followed by One-Way ANNOVA whose results are presented in Table 5.

Table 5. One-way ANOVA test summary achievement of student mathematical understanding ability based on AQ level

|                     | Sum of Squares | df | Mean Square | F      | Sig. |
|---------------------|----------------|----|-------------|--------|------|
| Between Groups      | 47.082         | 2  | 23.541      | 8.705  | 0.001|
| Within Groups       | 140.627        | 52 | 2.704       |        |      |
| Total               | 187.709        | 54 |             |        |      |

Table 5 show that there are differences in the ability of students' mathematical comprehension to be reviewed based on AQ level (Climber, Camper, Quitter). To find out which groups of students at the AQ level different significantly from their mathematical comprehension abilities, the continued with the Turkey HSD test (Table 6).

Table 6. Tukey's HSD test on students' mathematical understanding abilities based on AQ level

| (I) Adversity Quotient | (J) Adversity Quotient | (I-J) Mean Difference | Std. Error | Sig. |
|------------------------|------------------------|-----------------------|------------|------|
| Climber                | Camper                 | 0.844                 | 0.534      | 0.263|
| Climber                | Quitter                | 2.297*                | 0.556      | 0.000|
| Camper                 | Quitter                | 1.453*                | 0.542      | 0.026|

Table 6 show that there is a difference between the achievement of mathematical comprehension abilities of the students with AQ Climber level and those with AQ Quitter and the AQ Camper level with AQ Quitters. But there was no difference at the AQ Climber level with AQ Camper.

The results of the study showed that AQ had an influence on the achievement of students' mathematical understanding abilities. This is supported by the average achievement score (mean) of students' mathematical understanding ability with AQ Climber that is better than AQ Camper which is also better than AQ Quitter (12.94> 12.1> 10.65).

The influence of the factor AQ (Climber, Camper, Quitter) on the achievement of the ability of mathematical understanding is supported by the research of Yanti & Syazali [13] who concluded that
the level of AQ (Climber, Camper, Quitter) has an influence on the achievement of thinking processes of students. In addition, Yanti & Syazali [13] also found categorization related to the level of AQ, that in the process of thinking and solving mathematical problems, students with AQ Climber tend to be conceptual. Then the thinking process of students with AQ Campers in solving mathematical problems tends to be semi-conceptual; while students with AQ Quitters tend to have computational thinking processes in solving mathematical problems.

Retna, Mubarokah, & Suhartatik [15] argue that students with AQ Climber belong to a conceptual thinking process, students with AQ Camper have semi-conceptual thinking processes, while students with AQ Quitters think processes are still computational. This is in line with the research of Fauziyah, Usodo, & Ch [16] which argues that students with AQ Climber are able to understand the problem well and in a relatively short time, in contrast those students who are classified as AQ Campers only able to understand the problem quite well even though in a fairly short completion time. Meanwhile, the students with AQ Quitters, they have not been able to understand the problem and refuse to solve the problem with something new. In addition, students with AQ Quitter show little ambition in solving problems, just running the command given. This is also in line with the opinion of Hidayat & Sariningsih [17] who concluded that the reach factor, which is one indicator of AQ, was a predictor in the process of problem solving done by someone. But for someone who has AQ Quitter, it will often have difficulty resolving non-routine problems.

4. Conclusion
Based on the results and discussion, it can be concluded that: (1) AQ gives positive influence to the development of mathematical understanding ability of pre-service mathematics teacher with the influence of 57.7%, while the rest of it (42.3%) is influenced by other factors outside AQ; (2) there are differences in achievement in mathematical understanding ability of pre-service mathematics teacher based on AQ level (climber, camper, quitter).

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