Effect of adversity quotient of junior high school students on reflective thinking process in mathematical problem solving

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Abstract. This research wants to be seen reflective thinking process of grade VIII students at SMP N 4 Karanganyar based on Adversity Quotient (AQ) level of students. The subjects of this study were chosen by purposive sampling. AQ is the ability of a person to survive in the face of a problem. AQ has 3 levels of climber, camper, and quitter. Based on the AQ test results are taken students with climber, camper, and quitter level with different scores. The climber level is the highest level with an AQ score between 135 until 200, camper level is medium level with score AQ 60 until 134, and the quitter level is the lowest level with a score of 59 until zero. Data collection techniques use task-based interviews. The results showed that the thinking process of students with AQ scores of climber level was different from students with camper and quitter level. Students with AQ climber level, reflective thinking in the defining stage of the problem, analyzing problems, selecting categories, analyzing information, providing solutions, selecting solutions, implementing solutions, and analyzing feedback on all C-5 and C-6 type. Students with AQ climber level, reflective thinking at all stages when solving items of type C-5 only, while for item type C-6 students think reflectively only in the stage of analyzing information, providing solutions, choosing solutions, implementing solutions and analyzing bait behind. Furthermore, for students with AQ quitter level, reflective thinking is only in the stage of analyzing information, giving solution and implementing solution for item type C-5, while item of C-6 student can only go through phase analyze information only.

1. Introduction

One intelligence in humans that is still rarely considered is the intelligence of Adversity Quotient (AQ). Students must have the fighting power to get out of the difficulties they face. In learning mathematics, students need to have a high AQ, to be able to learn the material well, because students tend to regard mathematics as a difficult science [1]. AQ is a person's ability to face adversity challenges in his life [2]. The types of AQ a person can be grouped into 3, namely the types of fighters who succeed to achieve their goals called climbers, there are also those with the results that they get now are quite satisfied who are called campers, and the other ones who lack the enthusiasm to achieve their goals called quitters. The climber level is the highest level with an AQ score between 135 to 200, camper level is a medium level with AQ score 60 to 134, and the quitter level is the lowest level with AQ 59 score down [3].

There are four main components of AQ which are often called CO2RE, namely C: Control, O2: Origin and Ownership, R: Reach, and E: Endurance [3]. According to Cura and Gozum, AQ components such as Control, Origin and Ownership have a significant relationship with the mathematics achievement of respondents in the study. AQ levels and mathematical achievement of respondents are significantly related to each other [4]. The linkages are also influenced by the thought process. One of them is the process of reflective thinking.
Reflective thinking is an important aspect that must be possessed by a student in the learning process [5]. Reflective thinking is most important in prompting learning at a time of complex solving situations due to the fact that it avails the opportunity to go backwards and think about how they actually to solve problems and how a particular set of problem-solving strategies is appreciated for achieving their goals [6]. Reflective thinking provides an opportunity for the students to improve their weakness [7]. Reflective thinking is important for students, especially helping them in solving math problems, because they can use their experiences related to the problems faced [8].

Reflective thinking is very important for students and teachers [9]. However, this is very different from the facts in the field, where in mathematics learning, reflective thinking gets less attention from the teacher. Reflective thinking activities are often not done effectively and are difficult to familiarize students [10]. This is in line with the preliminary study conducted by Nindiasari [11] who obtained several findings, one of which is that more than 60% of middle school students have not been able to complete mathematical reflective thinking tasks, for example the task of interpreting, linking, and evaluating. Based on this, the teacher needs to work on the ability to reflect reflective students in solving mathematical problems.

There are eight important steps that need to be done in reflective thinking according to Primrose, namely: (1) defining problems, (2) analyzing problems, (3) selecting categories, (4) analyzing information, (5) providing solutions, (6) choosing solutions, (7) carrying out solutions, and (8) analyzing feedback [12]. Jozua Sabandar revealed that to develop students' reflective thinking skills, students must be involved in a problem solving [13].

The problem solving process provides an opportunity to learn and think about the best strategies, so that reflective thinking is a means to encourage thinking processes during problem solving [10]. Reflective thinking is very necessary for students to solve problems, because in this activity, students must be able to predict the right answers immediately so that they can explore problems by identifying mathematical concepts or formulas involved in mathematical problems, using various strategies or providing various mathematical concepts certain [14]. Nugent and Vitale explained that problem solving involves identifying problems, exploring alternative solutions, implementing alternatives or solutions that are chosen, and drawing conclusions [15].

It can be said that AQ influences students' thinking processes in this case, namely the process of reflective thinking. Reflective thinking process is needed by students in solving mathematical problems so that students can improve the quality of their work and students will be better prepared to deal with various forms of problems.

2. Methods
This research is classified as a qualitative descriptive study. This study emphasizes the description of reflective thinking in the process of solving mathematical problems, so this research can be categorized in the form of a case study research strategy. Researchers collect data on students' reflective thinking through student activities, and observe all events that occur during the subject to solve problems. Auxiliary instruments in the form of observation sheets, written tests of mathematical problem solving in the form of a description test as a basis for conducting interviews to see the reflective thinking process, and a questionnaire as a measuring tool for AQ.

3. Results and Discussion
Learning activities in the classroom study the chapter on the Two-Variable Linear Equation System of the eighth grade of the odd semester. At the initial stage a questionnaire is given to students to measure student AQ. Of the 31 students who filled out the questionnaire produced the student AQ at the level of climber, camper, and quitter. Based on the overall level of climber, camper, and quitter, three students were taken with the results as shown in Table 1.
Table 1. Adversity quotient questionnaire score data

| Student | Score | Level  |
|---------|-------|--------|
| 1       | 162   | Climber|
| 2       | 127   | Camper |
| 3       | 59    | Quitter|

Furthermore, the students are given a description of the problems related to the material of the Two-Variable Linear Equation System. The first problem is a furniture company will make two types of benches, namely three-legged benches and four-legged benches. Both types of benches use the same type of foot. On one occasion, the company received an order of 340 feet for 100 benches. How many types of benches will be produced?. Then the second problem is below are three tower shapes that have different heights and are composed of hexagon and rectangular shapes, shown in Figure 1. Tower (a) has a height of 21 meters and tower (b) has a height of 19 meters, so what is the shortest tower height?

![Figure 1. Picture illustration for the second problem](image1.png)

After being given a description test and interviews with the three respondents, the following results were obtained as shown in Figure 2.

![Figure 2. Results of solving the problem of the 1st student](image2.png)

Furthermore, based on the results of interviews with students 1, the student has used the reflective thinking process at each stage. In questions number 1 and 2, the student begins to understand the problem by trying to remember problems that are similar to the problem so that being able to define and analyze the problem is a problem regarding the two-variable linear equation. Furthermore, the student can find out information about the problem, namely what is known and what is asked. Furthermore, the student chooses to use elimination and substitution solutions to solve problems. The student also checks whether the solution is correct or not.
Based on the results of interviews with students 2 in Figure 3, the student was not fully reflective thinking process when solving mathematical problems. In problem number 2, students had difficulty analyzing questions to get information from the problem. Then little by little the student can analyze the problem well but has not been able to define it. From the information that has been obtained the student is able to choose a solution and implement it by using the method of elimination and substitution. The student also checks before making sure that the answer is correct. As for problem number 1, the student has difficulty analyzing and defining questions. So that students have difficulty getting information to solve mathematical problems. The student felt confused about the sentence. But the student still wants to work on even though there is a mistake in working on when analyzing information.

Based on the results of interviews with students 3 as shown Figure 4, the student was not yet fully involved in the process of reflective thinking in solving mathematical problems. In question number 1 and 2 this student only wrote down the information he understood because he was still confused in reading the question.

4. Conclusion
The results showed that there were differences in students’ reflective thinking process with Adversity Quotient scores at climber level, camper level and quitter level. Students with Adversity Quotient climber level, reflective thinking in defining the problem, analyzing problems, selecting categories, analyzing information, giving solutions, choosing solutions, implementing solutions, and analyzing
feedback on all items of type C-5 and C-6. Students with Adversity Quotient climber level, reflective thinking at all stages when completing item C-5 only, while for items C-6 type students think reflective in the stage of analyzing information, giving solutions, choosing solutions, implementing solutions and analyzing feeds turn back. Furthermore, for students with Adversity Quotient Quitter level, reflective thinking is only in the stage of analyzing information, providing solutions and implementing solutions for items of type C-5, while the C-6 items of students can only go through the stage of analyzing information.

References
[1] Hastuti T D, Sari D R and Riyadi 2018 J. Phys.: Conf. Ser. 983 012131
[2] Cando J M D and Villacastin N L 2014 Int. J. Sci. Basic Appl. Res. 18 345
[3] Stoltz P G 2003 Adversity Quotient, Mengubah Hambatan Menjadi Peluang (Jakarta: Grasindo)
[4] Kusumadhani D N, Waluya S B and Rusilowati A 2015 Int. Conf. Math. Sci. Educ. 2015 ME 18
[5] Ayazgok B and Aslan H 2014 Procedia-Soc. Behav. Sci. 141 781
[6] Odiba I A and Baba P A 2013 J. Educ. Pract. 4 2222
[7] Agustan S, Juniati D and Siswanto T Y E 2017 J. Phys.: Conf. Ser. 893 012002
[8] Rasyid M A, Budiarto M T and Lukito A 2018 J. Phys.: Conf. Ser. 947 012041
[9] Gurol A 2011 Energy Educ. Sci. Technol. Part B: Soc. Educ. Stud. 3 387
[10] Moss J 2010 Aust. J. Teach. Educ. 35 43
[11] Nindiasari H 2011 Prosiding Semin. Matematika & Pendidikan Matematika Univ. Negeri Yogyakarta 978 – 979 – 16353 – 6 – 3
[12] Polya G 2015 How To Solve It a New Aspect of Mathematical Method (Princeton Science Li Edition) (New Jersey: Princeton University Press)
[13] Kashinath K S 2013 Glob. Online Electron. Int. Interdiscip. Res. J. (GOEIRJ) Spec. Issue-1 Reflective Educ. 2 331
[14] Kurniawati L, Kusumah Y S, Sumarmo U and Sabandar J 2014 J. Educ. Pract. 5 2222
[15] Fahim M and Pezeshki M 2012 Int. J. Educ. 1 153