Flexibility in Mathematics Problem Solving Based on Adversity Quotient

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Abstract: Flexibility is an ability which is needed in problem solving. One of the ways in problem solving is influenced by Adversity Quotient (AQ). AQ is the power of facing difficulties. There are three categories of AQ namely climber, camper, and quitter. This research is a descriptive research using qualitative approach. The aim of this research is to describe flexibility in mathematics problem solving based on Adversity Quotient. The subjects of this research are climber student, camper student, and quitter student. This research was started by giving Adversity Response Profile (ARP) questioner continued by giving problem solving task and interviews. The validity of data measurement was using time triangulation. The results of this research shows that climber student uses two strategies in solving problem and doesn’t have difficulty. The camper student uses two strategies in solving problem but has difficulty to finish the second strategies. The quitter student uses one strategy in solving problem and has difficulty to finish it.

1. Introduction
One of the important topics in mathematics education is an effort to increase the ability of student to practice meaningful learning process. The ability to use the flexible strategy is called flexibility. Flexibility is one of the indicators to measure one’s creativity [1]. Flexibility is the ability to select appropriate procedures for particular problems and modify such procedures [2]. The individual's flexibility of mind can possibly be indicated in several ways by means of test. Although they have disappointments to establish a common factor of this type, the concept of flexibility and its probable opposite, rigidity, will not be downed [3].

Flexibility have a strong connection with the ability of solving problem. Creative thinking can be improved with flexibility, and with the use of problem solving techniques. The students should be asked challenging question to improve their flexibility in mathematics. It is commonly believed that divergent thinking exercises should be done in the class [4]. By the problem solving, the students are expected to create many ideas. The applied problems must possess many strategies so that it can arise students’ flexibility.

The ability of solving problem seems to be an important one that must be developed through mathematic learning. By learning problem solving in mathematics, students will acquire ways of thinking, habits of persistence and curiosity, and confidence in unfamiliar situations that will serve them better outside of the mathematics classroom [5]. Problem solving is a process of accepting problem as a challenge to solve them [6]. Problem solving steps which is applied in this research including four steps. They are understanding the problem, devising a plan, carrying out the plan, and looking back [7].
Students’ successful factor in solving problem is influenced by some ways, one of them is students’ difficulty level. The difficulty encountered by two students might be different in the same problem. The difficulty is the students’ opportunity to increase their ability. Therefore, the students must motivate themselves and try to overcome their difficulties in solving problem. Because of that, adversity quotient (AQ) is needed in learning process. Adversity quotient is an intelligence to cope with difficulties [2], in addition, adversity quotient can be called as the intelligence to change difficulty to be an opportunity [8]. There are three categories of AQ namely climber (high), camper (medium), and quitter (low) [9].

Through problem solving in this research, students are expected to be able to produce many strategies to solve their problems. The used problems must possess many ways to solve the problems so that it can show the criteria of flexibility. But, students must be categorized based on AQ before they are given problem solving tasks.

Some researches discussed about flexibility. One of them was Arslan & Yazgan. They compared flexibility by using many strategies to solve four of non routine mathematics problems which are given to 6th, 7th, and 8th grade students [10]. Many researches connected flexibility with student ability or student class level, but in this research flexibility is connected with adversity quotient. The aim of this research is to describe students’ flexibility in mathematics problem solving based on Adversity Quotient. This research can be used as an informative solution for mathematics teachers about students flexibility in mathematics problem solving based on adversity quotient to design student learning and as the reference for other researches who will be having the same topic as this paper.

2. Research methods
This research was done in Junior High School students in Surabaya city, Indonesia. The subject of this research consisted of three students representing three categories of AQ namely climber student, camper student, and quitter student. The instrument of this research involves mathematics problem solving task used to describe flexibility. The data collection was done by way of the interview based on the task. Data analysis in this research consists of three steps namely condensing data, presenting data, and conclusion. The written and interview data are analyzed according to indicators of flexibility on every steps of problem solving.

3. Results and Discussion

3.1 Results
The result of this research shows that the three subjects were solving problems with different strategy. Climber student succeeded to solve the problem by two strategies. Camper student did the same as climber student did, but she failed to finish the second strategy and the answer of the two strategies weren’t correct. Quitter student only used one strategy to solve the problem and her answer wasn’t correct.

3.1.1 Climber Student
Climber student was able to implement two strategies namely sketch and scheme successfully with the correct answers. In sketch strategy, she understood the problem situation correctly. She understood that the parts of agriculture land among children were connected one another. Then, she tried to illustrated by picture. She illustrated rectangle as a whole agriculture land. She divided it based on the rules in the problem. She created variable \( L \) as a whole agriculture land and succeeded to finish the answer as seen in figure 1.
In the second strategy, she chose to use scheme to solve the problem. Her understanding about the problem was consistent in that scheme. She created three variables namely $x, y, z$. $X$ means the whole agriculture land, $y$ means the rest of first land, while $z$ means the rest of second land. Then, she started to determine the value of the three variables until the final answer, and she got $x = 120$ ha (as seen in figure 2).

3.1.2 Camper Student
Camper student was able to make two strategies namely fraction addition and sketch. In fraction addition strategy, she can implement it until she finish it but the answer is wrong. In sketch strategy, she was not able to implement it although her ways and understanding are correct. In fraction addition strategy, she didn’t succeeded to understand the problem. She thought that the parts of agriculture land among children were not connected one another. Because of her misunderstanding, she answered the wrong answer in the next steps as seen in figure 3 and 4.

Figure 1. Sketch strategy

Figure 2. The final answer in scheme strategy.

Figure 3. Fraction addition strategy
Figure 4. She tried to calculate the area of agriculture land of every child. She got the final answer of 7100 ha.

She tried to use illustrate the picture in the second strategy. But, her understanding about the problem changed. She succeeded to understand that the parts of agriculture land among children were connected one another. But, she failed to finish the second strategy. She told that she got difficulties to continue because she had no ideas to connect the picture with the problem situation as seen in figure 5.

Figure 5. Sketch strategy.

3.1.3 Quitter Student
Quitter student didn’t understand the problem. She only used one strategy to solve the problem. She thought that the parts of agriculture land among children were not connected one another. In the next step, she did simple calculation. She added the three part of Alan, Alesha, and Adib and then she determined the result in hectare. After that, she added it with Abhi’s and she got 35,994 hectare. She tried to assume the final answer to became 36,4 hectare but she wrong.

3.2 Discussion
Based on the result and the interview from the three students, not all of the subjects encountered difficulties in every step in problem solving. But, the connection between flexibility an AQ become clear in the third steps of problem solving that is carrying out the plan.

Student with high level of AQ (climber) was able to show flexibility by using two different strategies to solve the problem. Although at the beginning she tried to change the picture to be scheme, but she succeeded to finish her scheme. The climbers like challenge and wasn’t easy to give up when they meet the difficulties [10].

Student with medium level of AQ (camper) was less able to show flexibility because she wasn’t able to finish the second strategy. She decided to give up when she find difficulties. The campers like to be in the comfort zone. They feel satisfied when the succeed to achieve something but they refused to get something better [10].
Student with low level of AQ (quitter) wasn’t able to show flexibility because she only used one strategy to solve the problem. She didn’t want to try another strategy. The quitters didn’t like the challenge. They didn’t like to try something new in their lives [10].

4. Conclusion
Based on the research, it can be concluded that climber student can show flexibility and is able to cope with difficulties. Camper student is less able to show flexibility because she can’t cope with difficulties in the second strategy. Quitter student isn’t able to show flexibility because she only use one strategy to solve the problem.

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