Level of mastery of mathematical skills and mathematical resilience

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Abstract. This study aims to analyze mathematical resilience based on the level of mastery of students' mathematical skills in solving word problems. This research was a mix-method study with selected research subjects who were four independent learners, three instruction learners, and three frustration learners of class VII in Baleendah. The instruments of this study were test and non-test (interviews and mathematical resilience questionnaires). The results showed that: (1) the excellent mathematical resilience of the independent learner impacted the positive outcomes of students in overcoming difficulties that existed in mathematical application problems. But, students' who had good mathematical resilience (medium category) didn't affect overcoming obstacles in word problems; (2) good mathematical resilience (medium category) from the instruction learner had a positive impact on overcoming challenges in word problems. Mathematical resilience in frustration learner (medium category, but partly low group) had an effect on the complexity of solving mathematical problems, and (3) mathematical resilience in frustration learner who got very low/low grade affects the challenge of solving mathematical application problems. However, students at the level of frustration have an excellent resilience ability (medium category) but do not modify the difficulties they experience (still having trouble) in solving word problems.

1. Introduction

As we all know, each student's learning ability is different because each individual has a diverse intelligence background. Intelligence is the ability of individuals to provide solutions to current problems and anticipate future situations. Therefore, when viewed from the learning ability of students, it can be grouped into three groups of students, namely: groups of a high, medium, and low ability students. Mastery of mathematical skills in students is divided into three type [1]. Independent learners are those who can solve mathematical problems in applicative problems. It means that they have understood mathematical skills (showing a percentage of 76% and above). Therefore, an independent learner might complete a task/problem without significant difficulties or obstacles. It is because the level of mastery and knowledge of independent learners is outstanding, so they only need a little learning to develop their abilities. Instruction learners have mathematical skills in the quantitative dimension but fail in the qualitative aspect (showing a percentage of 50%-75%). An instruction learner already has right enough basic knowledge and abilities so that the knowledge and skills he already has will be used to build new knowledge from the given problem. It shows that students at the instructional level try to
provide the best process between new learning and familiar subjects when solving problems. In other words, the instruction learner tends to persist in trying to solve a task or problem. Frustration learners fail to complete the mastery of quantitative dimension mathematical skills (showing a percentage below 50%). For frustration learners, the task or problem is too difficult to learn. Students won't learn because they don't have enough understanding to acquire and maintain skills. Therefore, frustration learners tend to ignore the given task.

Students are in the category of frustration learners; one of the causes can be due to teaching materials that are too difficult [2]. Conversely, if the content is too easy, it results in boredom for independent learners. Instruction learners are among boredom and frustration, where teaching materials or problems provide the appropriate level of challenge. If analyzed based on solving mathematical problems (correct answers), then the proportion of frustration learners is 0–74%, instructional learners are 75–90% and independent learners are 91–100%. Linearly also about the speed and accuracy in reading (stories/problems). Frustration learners have limitations in processing information due to improper meaning of words. Besides, the level of error in reading information tends to be high compared to instructional and independent learners [1].

A good intelligence ability implies better analytical skills, creativity, and problem-solving and should be implemented in life problems [3]. On the other hand, academic achievement is the achievement of students' learning outcomes [4]. Learning achievement is the success of students achieving the goals set in an (educational) program [5]. The results obtained are related to the academic abilities possessed by the individual. The lack of achievement in learning (mathematics) is influenced by resilience. It is caused there was a positive and significant relationship between mathematical resilience and students' academic abilities, with a contribution of 48.5% mathematical resilience to students' academic skills [6].

Based on the relationship that exists between resilience (mathematical) and academic ability of students, individuals with good intelligence should have better self-help abilities. It is caused by individuals with excellent knowledge who will actively seek solutions to a problem and deal with stress or pressure [7]. Also, children with good intelligence when living in a substantial or stressful environment will be more easily adapted to the environment and severe conditions. But on the one hand, the cognitive-affective personality system that a person's attitude, including resilience, can be formed due to various aspects interconnected with one another, not only intelligence [8].

The experience is one of the factors that influence the formation of one's resilience [8]. The experience will be treated cognitively as learning to deal with future events. In this case, the role of cognition or intelligence tends to influence the process [8]. It is supported by previous studies' results, which identified factors that enable a person to be resilient, including personal factors (social skills, physical attractiveness, and good intelligence) and environmental factors, namely parenting patterns from parents or significant others [9, 10, 11].

There are four indicators of mathematical resilience used in this study [12]: (1) learning mathematics is valuable, meaningful, useful, and beneficial for his life; (2) Learn from mistakes, give positive responses, and never give up negative or stressful situations he faces when studying mathematics; (3) having a strong desire, persevering, trying hard to continue to struggle difficult challenges or conditions; and (4) persistent, diligent, confident, and confident in ability, understanding, and experience that is on him to study mathematics.

2. Methods

Researchers use purposive sampling as a sampling technique because researchers determine the characteristics of the subject based on the phenomena to be analyzed by researchers [13]. This study's research subjects were junior high school students in the Baleendah area, Bandung Regency. More specifically, are students (male and female) class VII in the second semester of the 2019/2020 school year with an average age between 11–13 years. The number of research subjects was ten people with a ratio of four students from the independent learner group, three students from the instruction learner group, and three students from the frustration learner group.

The instruments of this study were test and non-test (interviews and mathematical resilience
questionnaires). Resilience questionnaires were modified from Resiliensi Matematik (3rd Mathematical Resilience) [14]. This instrument was given to all research subjects after they completed the test of mathematical problem-solving abilities. Questionnaires consisted of 42 statements and were measured using a Likert scale. Also, researchers with students and mathematics teachers conducted interviews. It aims to dig up information on everything related to the teaching and learning process. Data and facts collected from this journal can be used as research supporting data.

3. Result and Discussion

3.1. result

A mathematical resilience questionnaire was given to 10 participants who were the subjects in this study. Questionnaires were given after they finished working on the test. They were given time to fill out the survey by their own opinions. Table 1 shows the results of mathematical resilience measurements for each indicator.

| Participants | Total Score | Category | Total Score | Category | Total Score | Category | Total Score | Category |
|--------------|-------------|----------|-------------|----------|-------------|----------|-------------|----------|
| S1A          | 37          | Medium   | 36          | Medium   | 30          | Medium   | 32          | Medium   |
| S2A          | 42          | High     | 38          | High     | 34          | High     | 33          | High     |
| S3A          | 43          | Very High| 43          | Very High| 39          | Very High| 36          | Very High|
| S4A          | 34          | Medium   | 34          | Medium   | 30          | Medium   | 33          | High     |
| S1B          | 33          | Medium   | 35          | Medium   | 30          | Medium   | 30          | Medium   |
| S2B          | 33          | Medium   | 35          | Medium   | 32          | Medium   | 30          | Medium   |
| S3B          | 35          | Medium   | 30          | Low      | 29          | Medium   | 28          | Low      |
| S1C          | 23          | Very Low | 30          | Low      | 26          | Low      | 26          | Very Low |
| S2C          | 32          | Medium   | 32          | Low      | 30          | Medium   | 32          | Medium   |
| S3C          | 30          | Low      | 30          | Low      | 25          | Low      | 32          | Medium   |

Table 1 shows the distribution of mathematical resilience categories from ten research subjects. The questionnaire results illustrate that not all students at the independent level have high or very high mathematical resilience. The mathematical resilience of two of the four independent learners that researchers observe is in the medium category. As shown in Table 1, S1A is in the medium category for each indicator of mathematical resilience. The S4A in indicators 1, 2, and 3 is in the medium category, but indicator 4 is high. It shows that S4A has high confidence in learning mathematics based on his understanding and experience. Besides, S4A has a top belief that solving math problems requires persistence, perseverance, and hard work. Unlike S1A and S4A, the mathematical resilience of S2A and S3A consistently and sequentially is in the high category and is very high for the four indicators of mathematical resilience. These results can be interpreted that S2A and S4A provide positive perceptions in addressing problems that exist in mathematics.

In the instruction learner group, S1B and S2B showed consistent results on the mathematical resilience questionnaire, both of which are in the medium category for the four indicators of mathematical resilience. S3B displays different results. In indicators 1 and 3, S3B has a medium grade, while indicators 2 and 4 have a low category. The results of S3B on index 2 are low. It shows that S3B gives a negative perception of the attitude of resilience in learning mathematics. That is, S3B does not want to learn from mistakes, gives negative responses to stressful situations that it faces when learning mathematics, and S3B quickly gives up on problems that are difficult to solve. The low yield of S3B on indicator two is also followed by the low return on index four, where the scope of index 4 discusses persistence, perseverance, beliefs, and confidence in their understanding, experience, and abilities when
studying mathematics. If S3B is at a low criterion in indicator 4, it can be interpreted that S3B is not sure of its ability. S3B is still doubtful about the previous understanding and experience. That is, S3B is not sure of the development (growth) of learning mathematics on her.

One in three students from the frustration learner group showed inconsistent results, namely S2C. The mathematical resilience questionnaire results from S2C give results with moderate criteria for indicators, 1, 3, and 4. The S2C obtains low standards on index 2. Profound effects of S2C on index 2 means that S2C gives a negative perception of resilience attitudes in learning math. That is, S2C does not want to learn from mistakes, gives negative responses to the demanding situations they face when learning mathematics, and S2C quickly gives up on problems that are difficult to solve. However, this result contradicts the S2C results for indicators 3 and 4 in the medium category as it is known that index 3 discusses a strong desire to survive and strive to face stressful situations. In contrast, indicator 4 discusses persistence, perseverance, beliefs, and confidence in their understanding, experience, and abilities when studying mathematics.

Unlike S1C and S3C, their perception of a mathematical resilience questionnaire more consistent. S3C gets low results for indicators 1, 2, and 3, but in the medium category for index 4. That is, S3C provides a low/negative perception or view of the three indicators. The S1C obtained meager results on index 1 and 4. Shallow results on index 1 mean that S1C views that mathematics learning is worthless, meaningless, useless, and not useful for daily life. In other words, S1C believes that learning mathematics has no value in life. Meager perception results also obtained by S1C for indicator 4, that S1C does not want to develop to be better in learning mathematics. S1C is not sure of her abilities, and S1C still feels doubt about the understanding and experience that has been previously owned. That is, S1C is not sure of the development (growth) of learning mathematics on her.

Based on the categorization in Table 1, the researchers can determine the percentage of each mathematical resilience indicator, as displayed in Diagram 1 below.

![Diagram 1](image.png)

**Figure 1.** The distribution of categorization in the mathematical resilience indicator

Diagram 1 shows that the distribution of categorization for each measurable resilience indicator. Chart 1 above shows that mathematical resilience in the medium category dominates in every indicator of mathematical resilience, starting from signs 1, 2, 3, up to 4. On the other hand, the groups are very high and high, only 10% for each sign of mathematical resilience, except for index 4, which is 20% in the top class. It shows that only a small number of participants had very high and high mathematical resilience; even this did not reach half of the independent learner group. In indicators 2 and 3 for the
deficient category is 0%. Out of every participant involved in this study, no one was in the deficient grade for both indicators. As for the medium category, the distribution is reasonably evenly distributed for each indicator of mathematical resilience, ranging from 40–60%. It illustrates that mathematical resilience in the medium category is owned by the instruction learner group and part of the independent and frustration learner group. These results indicate that not all independent learners have high mathematical resilience, and not all frustration learners have low mathematical resilience.

3.2. discussion

Based on the results of the mathematical resilience questionnaire in section 3.1, it was found that some students from the independent learner group had moderate mathematical resilience abilities. These results can at least provide a general picture that students from independent learner groups are quite capable of controlling themselves when facing difficult situations and are willing to try to survive or rise from these difficult situations. This result follows the results of the previous study that there is a positive and significant relationship between mathematical resilience with students' academic abilities, with a contribution of 48.5% mathematical resilience to students' academic skills [6]. It is also consistent with researchers' findings from the analysis in section 3.1 that S2A and S3A consistently show high and very high resilience capabilities for each indicator. It is explained because individuals with high intelligence will actively seek solutions to problems and be able to deal with stress or pressure [7]. Independent learner groups with excellent mathematical abilities feel more confident with all their abilities so that some of them can suppress the pressure or difficulty that exists when studying mathematics.

However, an interesting fact that researchers found in this study was S3A's work on number 3 that S3A did not answer the problem at all. In other words, S3A chose to leave the answer blank because he does not understand how to solve the problem even though it has been tried several times on different papers. The findings are then investigated by asking the mathematics teacher directly who teaches face-to-face every day with the students. According to him, S3A is indeed one of the students who have above average mathematical abilities. The teacher also said that S3A was one of the students who were able to capture the lesson and understand the learning material faster than other friends. However, the weakness of S3A is when he feels unable to solve the problem; he prefers not to answer the question. It was not because he did not want to solve it, but because he felt ashamed if he responded wrongly. This fact is justified that a person's attitude (resilience) can be formed due to various aspects that are interconnected with one another, not only intelligence but also takes into account the cognitive-affective personality system [8]. Another interesting finding is the S1A work results, where S1A shows a decrease in results from tests I to tests III.

In the first test, the results of the S1A work, although not perfect yet, the researcher can see a relatively good understanding of the problems given in the first test. Based on the work results on the first test, the researchers suspect that S1A could be better on the second test. However, the researchers' suspicion of that is wrong. In the second test, S1A seemed unable to understand the problem and could not even understand the mathematical concepts related to the comparison. Furthermore, researchers further explore the results of the S1A from test III, where test III is the final test of the entire material in contrast. The content and type of questions in trial III are no longer new to students because they already learned the full comparison by the teacher. Besides, they already have experience working on word problems, at least during tests I and II. However, the S1A work results on test III differ from S2A, S3A, and S4A, which, on average, show a positive learning development. S1A does the work on the third test shows a decrease.

However, if seen from the results of the mathematical resilience questionnaire, S1A can be seen that S1A is in the medium category for each indicator on its resilience capability (see Table 2). In the S1A questionnaire, information was obtained that S1A felt it would not be a problem if they did not understand the math problems provided as long as he could get the right answer. On the other hand, S2A, S3A, and S4A, gave opinions that contradicted S1A, namely strongly disagree with the statement. It shows that according to S2A, S3A, and S4A, to get the right answer to a problem, it requires an advanced understanding of the problem's contents. However, S1A responds that there is no need to
understand the problem's content to get the correct answer. It indicates that S1A is opportunistic in character (relying on luck). This finding is in line with another opinion in the previous study that language skills demonstrate good mathematical resilience for expressing mathematical understanding and mastering mathematical learning theory [14].

In other words, a person with high resilience will provide clear and logical arguments related to the results of the mathematical work he completed. It's consistent with the findings obtained by researchers from this study on research subjects S2A and S3A. With students' strong mathematical resilience, students can be considered successful in mathematics in schools, even in conditions and situations that are not favorable or difficult [15, 14]. However, poor mathematical resilience is shown by not being able to have language skills to express mathematical understanding, and not master mathematical learning theory as happened in S1A research subjects. S1A is not able to provide explanations/arguments that are clear and logical in every given problem.

In the frustration learner group, S1C gets very low and low categories from the measured mathematical resilience indicators. Based on Table 2, S1C strongly agrees that learning mathematics has no value, meaningless, useless, and not beneficial. Also, S1C doesn't believe in her ability. The implications of these negative perceptions of S1C mathematics learning are poor learning outcomes. That is, there is harmony between the opinions that are embedded in students and the achievement of knowledge. It is consistent in that the ability to form resilience includes optimism and the ability to achieve what is desired [16]. It means that a positive attitude is needed to achieve positive results. Another case from the S2C questionnaire results, which mostly obtained a medium category even though the achievement of learning mathematics is still low. It proves that resilient children do not necessarily have to be gifted or exceptional. Still, the most important thing is that they can adapt to their potential or abilities [8]. From this fact, the researcher can say that even though S2C in terms of academic proficiency (mathematics) is at the level of frustration learner, S2C has a positive perception of mathematics learning. S2C is of the view that learning mathematics will have a positive impact on life. Therefore, S2C considers it necessary to learn mathematics (although in terms of mathematical skills are still lacking).

In the instruction learner group, mathematical resilience is dominated by the moderate category, especially in the S1B and S2B research subjects (see Table 2). However, from the results of work on tests I to tests III, both S1B and S2B lead to positive learning development. The ability of mathematical resilience in S1B and S2B in the medium category has a positive impact on the development of learning in solving problems in the form of word problems. However, based on the results of the questionnaire that S3B does not want to learn from mistakes, gives negative responses to the demanding situations they face when learning mathematics, and S3B quickly gives up on problems that are difficult to solve. S3B also felt unsure of the development (growth) of learning mathematics in her. It is consistent with the results of the work displayed by S3B in tests I, II, and III. S3B seems to give a negative response every time it is faced with difficult questions, such as emptying answers or originating answers. The doubts that exist in S3B in solving math problems are lack of experience and the lack of S3B's ability to study mathematics in the quantitative dimension. As a result, there is an attitude of insecurity and uncertainty in S3B when given an applicable mathematical problem.

4. Conclusion
The results showed that: (1) the excellent mathematical resilience of the independent learner group had an impact on the positive outcomes of students in overcoming difficulties that existed in mathematical application problems. Unfortunately, students with good mathematical resilience (medium category) do not affect their challenges when solving word problems; (2) the good mathematical resilience (medium category) of the instruction learner has a positive impact on overcoming difficulties in word problems. On the other hand, students with unfavorable mathematical resilience (medium category, but partly is a low category) have an impact on the difficulty of solving mathematical problems; and (3) unfavorable mathematical resilience (very low/low grade) in the frustration learner linearly to the challenge of solving mathematical application problems. However, there are also students at the level of frustration
which have a good resilience ability (medium category) but do not affect the difficulties they experience (still having trouble) in solving word problems.

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