



Growth Mindset in Mathematics in Junior High School: A Reflection on Students' Mathematics Learning Activities in a Science Specialization Class

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ABSTRACT

The growth mindset in mathematics is one of the important elements in learning mathematics. With these psychological aspects, students have beliefs that their mathematical intelligence can be developed through an active and diligent mathematics learning process, not being afraid when facing difficulties, not feeling satisfied with praise, and making positive inspiration for the academic achievements of other friends. This article presents the results of an exploration of the growth mindset in mathematics of students in private junior high schools who take science specialization classes. A total of 78 students participated in this study. All students were given a growth mindset scale in mathematics and analyzed quantitatively descriptively. The results of this study indicate that most students have a mixed math mindset, namely a fixed mindset with a little growth mindset (Fixed-Growth (FG)) of 56.41% or a growth mindset with a little fixed mindset (Growth-Fixed (GF)) of 39.74%. Meanwhile, students with a strong growth mindset (Growth-Growth (GG)) have a very small percentage of 3.85%. In terms of gender, male and female students are more dominant in the fixed mindset (Fixed-Growth (FG)) with a little growth mindset (male (55.88%) and female (56.82%)). Therefore, further research needs to be carried out to foster a growth mindset in mathematics learning activities through pedagogical interventions in these science specialization classes.

Keywords: *Growth Mindset in Mathematics, Mathematics Learning Activities, Science Specialization Class*

1. INTRODUCTION

Mathematics is a compulsory subject given to students in junior high schools in Indonesia. One of the achievements of learning mathematics at this level is to equip students to have thinking skills that are relevant to 21st-century abilities, such as mathematical reasoning, mathematical creativity, and critical thinking in mathematics [1]–[4]. However, in the process of learning mathematics, students do not easily follow mathematics learning well. As a result, many students experience math anxiety [5], especially when faced with solving non-routine math problems [6]. To be able to participate in learning

mathematics well, teachers must provide support and a conducive learning environment for students. One of the efforts that can be developed in students related to their psychological aspects is the growth mindset in learning mathematics [7], [8].

Regarding the growth mindset of students in learning, the results of the 2018 PISA study show that only about 29% of Indonesian students have a growth mindset and the rest of the students have a fixed mindset [9]. Based on the results of the study, many students assume that their intelligence cannot be changed or developed by learning. These results also confirm that the abilities possessed by students are considered as something that has been given

and not changed, instead of assuming that the abilities possessed by students are something that can be developed during the learning process. This situation is certainly worrying for students' academic achievement because this assumption will weaken students' abilities, including students' academic achievement when studying mathematics.

Theoretically, the concept of the human (student) mindset is divided into two types, namely the growth mindset and the fixed mindset [7]. The growth mindset is a person's belief that intelligence, abilities, talents, and other personal qualities can change with a process of learning, effort, and perseverance. While a fixed mindset is a person's belief that intelligence, abilities, talents, and other personal qualities have a fixed nature and cannot be developed

significantly, even through a learning process. In the context of learning mathematics, students who have a mindset still think that their intelligence, ability, and mathematical talent are fixed and cannot be developed even if they study mathematics diligently [10], [11]. Meanwhile, students who have a growth mindset believe that their intelligence, ability, and mathematical talent can be honed and trained with perseverance through the learning process [10], [11]. To find out whether students have a growth mindset or a fixed mindset when learning mathematics can be seen from the characteristics of five categories, such as challenges, obstacles, efforts, criticism/praise, and the success of others [7], [12]. The characteristics of the five categories are described in Table 1.

TABLE 1. Characteristics of students' habits with a fixed mindset and a growth mindset [7]

Category	Fixed Mindset	Growth Mindset
Challenge	Avoid challenges so that their weaknesses are not exposed	Choose or assess challenges as a means of learning
Obstacle	Give up in the face of obstacles encountered and generally setback	Stay strong in the face of obstacles and generally don't setbacks
Effort	The need to put in the effort is seen as a negative. If one has to try it is considered neither smart nor talented.	Working hard and putting forth effort is the way to results and success.
Critique/Praise	Valuing critique/praise as an encouragement to try/learn	Valuing critique as negative input even though it can build yourself better and praise as an acknowledgment of your talents
The success of others	The success of others is a threat and makes you sad and angry	The success of others as a source of inspiration and learning

In general, students with a growth mindset were more likely to exhibit behaviors that lead to academic success, such as the ability to ask questions, persist when faced with challenges or not setbacks, and act on positive feedback from others. On the other hand, some students with a fixed mindset who previously had high academic achievements were unable to overcome the challenges that were present, so they experienced setbacks and eventually failed [13]. Thus, this opinion indicates that students' growth mindset is important to develop in the mathematics learning process. In addition, students who have a growth mindset in learning mathematics tend to be successful in their mathematics academic achievement in class [14].

One class that is synonymous with talent and intelligence is a science specialization class [12]. The science specialization class is a class filled with students who have a high interest in learning mathematics and science subjects. Many people think that a science class is a class where students who excel in math and science academic achievement gather. This means that students in the science specialization class are gifted and have high achievements in mathematics and science. Therefore, the

following study will explore the growth mindsets in mathematics of junior high school students in a science class.

2. MATERIAL AND METHOD

2.1. Participant

The subjects of this study were 78 students who took a science specialization class at a private junior high school in the city of Yogyakarta. The number is categorized into three classes, namely class VII as many as 31 students, class VIII as many as 18 students, and class IX as many as 29 students, and categorized in terms of gender, namely male and female. The choice of this subject is based on the assumption that students who have a high interest in mathematics and science have high academic abilities so it is interesting to explore their growth mindset in mathematics.

2.2. The Growth Mindset Scale in Mathematics

In this study, the data collection technique uses a growth mindset scale in mathematics which consists of 10 items and is derived from the habitual characteristics of five categories of mindset, namely challenges, obstacles, effort, criticism/praise, and the success of others [7]. Examples of mindset scale items in mathematics for the challenge category, for example, "I like to try new things when learning mathematics, even though it is difficult for me" (Growth Mindset (GM). For the obstacle category, for example, "It's okay if I fail at solving math problems. This failure is an opportunity to study harder" (GM). For the business category, for example, "The frustration I experienced while studying math made me want to try harder" (GM). For other people's success categories, for

example, " When another friend excels in math, I feel inspired" (GM). For the criticism/praise category, for example, "I feel happy when I succeed in solving math problems that other friends cannot do" (FM).

2.3. Data Analysis

The data analysis of this research was done quantitatively descriptively. For this purpose, there are four levels of thought patterns in mathematics, including growth mindset-growth mindset (GM-GM or GG), growth mindset-fixed mindset (GM-FM or GF), fixed mindset-growth mindset (FM-GM or FG), and fixed mindset-fixed mindset (FM-FM or FF). Table 2 shows the categories of students' mindsets when learning mathematics.

TABLE 2. Categories of Students' Mindset in Mathematics

Categories	Description
FF (Fixed-Fixed)	A strong fixed mindset
FG (Fixed-Growth)	The fixed mindset with a bit of a growth mindset
GF (Growth-Fixed)	A growth mindset with a little fixed mindset
GG (Growth-Growth)	A strong growth mindset

3. RESULT AND DISCUSSION

3.1. Characteristics of the Mindset of Students in the Science Specialization Class

The Growth Mindset Scale in mathematics is given to all students taking a science class at a private junior high

school. The results obtained from the questionnaire contained several characteristics of the student's mindset in learning mathematics activities in science specialization classes. The characteristics of the student's mindset are shown in Table 3.

TABLE 3. Characteristics of Student Mindset

Classes	Characteristics of Mindset				Total
	FF	FG	GF	GG	
VII	0	16	15	0	31
VIII	0	13	3	2	18
IX	0	15	13	1	29
Sum	0	44	31	3	78
Percentage (%)	0,00	56.41	39.74	3.85	

Based on the data in Table 3, of the 78 students who took the science specialization class, there were 44 students (56.41%) who were very dominant with FG (Fixed-Growth) characteristics. That is, they have the dominant characteristic of a fixed mindset that is a little bit of a growth mindset. They still doubt that a person's mathematical intelligence can change and develop if they do math learning activities. In addition, they also feel inferior if their friends get better study results. However, there are few characteristics of a growth mindset in them. They believe that failure to solve math problems can

provide opportunities to study mathematics even more actively.

Furthermore, of the 78 students who took the science specialization class, there were 31 students (39.74%) who had the characteristics of GF (Growth-Fixed). They have the characteristics of a mindset that is dominated by a growth mindset, but there is a small amount of a fixed mindset. They believe that a person's mathematical intelligence can change and develop through the learning process. Then, they also keep trying even harder when they encounter difficulties and challenges in learning mathematics. When other friends have better math

achievements, they are inspired and motivated to follow suit. However, they still like to be praised when they get a high achievement compared to other friends.

Next, out of all students who took the science specialization class, there were only 3 students (3.85%) with GG (Growth-Growth) characteristics or a strong growth mindset, while students who had strong fixed mindset characteristics (FF or Fixed-Fixed) there is none. Students with strong growth mindset characteristics believe that mathematical intelligence can change with a more active learning process, like challenges, continues to face existing difficulties, are not lulled by other people's praise, and are inspired by the success of other friends.

Thus, the mindset characteristics of students who attend science specialization classes are dominated by a mixed mindset, namely the characteristics of a fixed mindset with a little growth mindset or a growth mindset with a little fixed mindset. Meanwhile, the number of students with

strong growth mindset characteristics is only small. This shows that students who take science specialization classes have doubts that their mathematical intelligence cannot change even with an active learning process. However, the student's beliefs can change if the teacher can provide the right growth mindset intervention so that students' self-confidence and motivation will increase and ultimately improve their academic achievement [14]–[16].

3.2. Characteristics of the Mindset of Students in the Science Specialization Class by Gender

The characteristics of the mindset of students in science specialization classes can also be mapped from gender. The characteristics of the student's mindset are presented in Table 4.

TABLE 4. Characteristics of Students' Mindsets Based on Gender

Classes	Gender								Total
	Male				Female				
	FF	FG	GF	GG	FF	FG	GF	GG	
VII	0	8	7	0	0	8	8	0	31
VIII	0	4	1	1	0	9	2	1	18
IX	0	7	5	1	0	8	8	0	29
Total	0	19	13	2	0	25	18	1	78
Total of Gender	34				44				
Percentage (%)	0	55.88	38.24	5.88	0	56.82	40.91	2.27	

They believe that mathematical intelligence can change through the learning process. However, they are still happy with the praise for their mathematical academic achievements. Meanwhile, only a few students have a strong growth mindset, both male (5.88%) and female students (2.27%). This means that only a few students, both male, and female, in the science specialization class think that mathematical intelligence can change and develop with the learning process, including they like to face challenges, do not back down when they encounter difficulties, and keep trying to solve them, and are not proud of other people's praise. others and inspired by the success of other friends. With a growth mindset pedagogical intervention, female students will have better academic achievements than male students [15], [16].

CONCLUSION

In general, it can be said that students who take science specialization classes are dominated by the characteristics of a fixed mindset with a little growth mindset (Fixed-

Growth or FG), both male and female students. Next, the characteristics of a growth mindset with a little fixed mindset (Growth-Fixed or GF) also dominate in this class with a percentage below it. Meanwhile, students with strong growth mindset characteristics (Growth-Growth or GG) have a very small percentage. Thus, it can be concluded that the mindset of students when doing math learning activities in science specialization classes tends to be a mixed mindset between FG and GF. Students assume that their mathematical intelligence is difficult to change or they doubt that active and diligent learning activities cannot change their mathematical intelligence. Therefore, further research can be carried out by focusing on the implementation of pedagogical interventions to foster a growth mindset in students' mathematics learning activities in science specialization classes.

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