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Students' Mathematical Disposition and Resilience: An Analysis of Student Perceptions in Numbers and Algebra Courses



Abstract: - Mathematics not only emphasizes the mastery of concepts and principles, but mathematics also has a mission to build student affection through mathematical disposition and resilience. Not only elementary students but also college students have the potential to have a negative attitude toward mathematics. If this happens, the dynamics of affection in mathematics learning must be questioned. To further the investigation, this study aims to analyze the perceptions of primary teacher education students from Sanata Dharma University in the Numbers and Algebra Course terms in the context of mathematical disposition and resilience. Through a qualitative approach involving 98 students from two different classes, the results of this study showed that: 1) factors that influence students' attitudes towards mathematics are their early motivation, 2) attitudes towards mathematics are related to activities and student learning outcomes, 3) aspects of mathematical disposition that need to be optimized are self-confidence and curiosity, 4) aspects of mathematical resilience to note are efficacy and resilience. This study has significant implications for implementing learning, especially in the context of mathematical disposition and resilience. The results of this study can be used as initial diagnostic recommendations in learning planning that leads to effective student outcomes.

Keywords: Mathematical Disposition, Mathematic Learning, Mathematical Resilience, Student Perception.

I. INTRODUCTION

Creative thinking, product innovation, new ways of thinking, individual mentality to be collaborative and communicative, and open-minded are the demands of human needs in terms of skills in the 21st century (OECD, 2019). These skills should be integrated into education as a spearhead for the creation of the Indonesian generation. Because education is one of the factors that can bring progress of a nation (Saad, 2015). Talking about education is certainly no stranger to learning activities. Where learning activities are activities in which there are students (people who study) and teachers (people who teach) who are active in communicating with each other, so that a process or teaching-learning activity occurs in it (Mujtahidin, 2014).

One of the subjects that is present since the elementary education level is mathematics. However, do students already know the importance of learning mathematics or can they just count and count? Mathematics is the science of structure, order and relations that has evolved from the basic practice of counting, measuring and describing the shape of objects. Even mathematics is also defined as a linguistic activity, which is marked by the association of words with the right meaning (Khait et al., 2005). So, mathematics should not only be interpreted as a symbol.

Mathematics is often interpreted as numeracy skills, where students with good numeracy skills are considered successful in learning mathematics. In fact, mathematics is not just counting, but broader than that such as problem solving skills and critical thinking (Purnomo, 2017). Besides that, mathematics also has a special affective value which is referred to as a mathematical disposition. This aspect is important for students to have because it relates to students' attitudes towards mathematics. However, mathematics learning activities in the classroom must encounter several obstacles both in terms of inculcating cognitive, affective and psychomotor concepts due to differences in abilities. Included in this is learning about numbers and algebra as part of mathematics.

Based on the results of preliminary studies that have been carried out through interviews with supporting lecturers, observation and documentation of learning activities that have been carried out by researchers. There are several findings of problems in the field as follows.

1. Some students show lack of enthusiasm, this is indicated by observation, interviews and documentation.
2. Student confidence in expressing opinions is still lacking, this is indicated from observation activities that students need to be given a stimulus, this was confirmed in interviews.
3. Students' curiosity is indicated to be lacking, this can be seen when observing that students are given the opportunity to ask questions but no one asks.
4. Some students experience difficulties, not in mastering the material. But on how to convey material as an elementary school teacher. The difficulties experienced by students have the potential to cause anxiety in learning. After being analyzed, the problems that occur in learning "Elementary Numbers and Algebra" are included in

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students' attitudes towards learning mathematics. In this case it is called "Mathematical Disposition" and is included in the realm of resilience or resilience to learning or "Resilience". Even though the two affective aspects of mathematics should be owned by students. Because these two things are related to attitudes or affective towards learning mathematics.

Mathematical disposition is a (mathematical disposition) that is desire, awareness, dedication and a strong tendency in students to think and act mathematically in a positive way (Akbar et al., 2017). According to NCTM (Supriyadi et al., 2017) defines that mathematical disposition is the tendency of students to think and act positively. So, a mathematical disposition is a positive attitude of students towards mathematics, to behave consciously and voluntarily in achieving the goals set in learning mathematics. Mathematical disposition is one of the aspects that must be considered in learning mathematics, because it is a determining factor for success in learning mathematics (Mandur et al., 2013).

Mathematics is often regarded as a material that is quite difficult (Nurhikmayati, 2017). Where the analysis of students' difficulties in learning mathematics is categorized into two, namely concepts and principles (Nurhikmayati, 2017). Several studies have shown that it is not only elementary school students who think that mathematics is difficult and full of challenges. Dirgantoro (Dirgantoro, 2019) in his research discussing the analysis of the difficulties of PGSD students in geometry courses, the results showed that students also had difficulties in learning mathematics as evidenced by the low student learning outcomes. A similar statement was also made by (Anditiasari, 2020; Juhana Senjaya et al., 2017; Özerem, 2012) that learning difficulties in mathematics are not only experienced by students in school, but also students in (Kereh et al., 2013; Wantika & Nasution, 2019).

The difficulties faced by students in learning mathematics make students feel anxious and try to avoid mathematics. Such behavior can of course be overcome by having a serious, tenacious and confident attitude which is called resilience (Maharani & Bernard, 2018). Resilience is important for a learner to have which affects the ability to understand mathematics. Because resilience is related to the activity of using mathematics, thinking and acting mathematically, not just to achieve grades or pass certain subjects (Marlina et al., 2022).

As a recommendation material and implementation of learning in the "Numbers and Algebra" course related to the affective aspects of mathematics. So this study aims to analyze student perceptions in terms of aspects of mathematical disposition and resilience during learning activities. The results of this study can later be used as a reference or recommendation for the implementation of learning and subsequent research on similar topics.

II. THEORETICAL UNDERPINING

A. *Mathematical Disposition*

The term disposition is often used to distinguish between the behavior, attitudes, traits and habits of each individual (Hakim, 2019). Where the tendency of each individual is reflected in every activity they face. In this case the learning activities carried out in class directly or indirectly also involve a disposition, including learning mathematics. Kilpatrick (Kilpatrick, 2010) defines that a mathematical disposition is a habit or tendency to see mathematics as something logical or reasonable, understanding that mathematics is useful and valuable, coupled with belief in the persistence of learning mathematics.

Mathematical disposition is also interpreted as a critical, thorough, objective and open attitude, appreciating the beauty of mathematics as well as curiosity and pleasure in learning mathematics (Syaban, 2009). The definition of a mathematical disposition is also expressed by Sumarmo (Sumarmo, 2010) which states that mathematical disposition is the desire to learn, awareness and dedication to think and act in every mathematical activity. So, from the several definitions that have been disclosed, the authors conceptually mean that a mathematical disposition is a positive tendency towards mathematics. While operationally it can be defined as a positive attitude towards mathematics which is characterized by high curiosity, attention and interest in learning mathematics, diligence, confidence, and respect for mathematics in its application in everyday life.

A learner is said to have a good disposition when fulfilling several aspects and indicators of a mathematical disposition. In this study the authors use several aspects that have been disclosed by (Syaban, 2009) with the indicators disclosed by (Muharomi & Afriansyah, 2022). The aspects and indicators are as follows: High curiosity is characterized by frequent asking questions, conducting investigations and reading a lot from other sources. Showing attention and interest in learning mathematics which is marked by focus and showing expressions of pleasure in learning mathematics. Perseverance is characterized by persistence, never giving up and earnest in learning mathematics. Self-confidence is characterized by confidence and courage in solving mathematical problems. Appreciate mathematics which can be shown by the application or use of mathematics in everyday life.

B. *Student Resilience*

Resilience is defined as the ability to face challenges, resilience will appear when someone faces a difficult experience and knows how to deal with or adapt to it (Utami, 2017). Grotberg (Utami, 2017) states that resilience is a universal capacity that allows a person, group or community to prevent, minimize or overcome the damaging effects of adversity. So, Resilience is the human capacity to face and overcome difficulties and be strengthened or

transformed by difficulties in life.

Difficulties in learning mathematics trigger negative behavior for students, namely feelings of wanting to give up, anxiety and others. Resilience is also defined as flexibility, which is very useful as a provision in dealing with difficult situations that cannot be avoided. Mathematics as a learning subject also requires good resilience so that the knowledge learned can be owned by a child. A concept of mathematical resilience as an important concept obtained based on the mathematical experience of students who tend to be "angry" and have the potential to "fail" (Johnston-Wilder & Lee, 2010)

In the concept of learning resilience is a concept about the ability of students to face problems and obstacles or described as the struggle of a learner in facing and overcoming obstacles (Hutauruk, 2020). Resilience is related to students' affective to face, overcome, be strong when facing obstacles and obstacles in the learning process. As with mathematical disposition, mathematical resilience also has aspects and indicators. In this case the researcher uses the theory according to (Hutauruk, 2020) which states that a person has good resilience if: has the belief that mathematics is something valuable and must be occupied, has the will and persistence in learning mathematics, has confidence in himself that he is able to learn mathematics and has a defensive nature characterized by an unyielding attitude, as well as giving a positive response in learning mathematics.

III. METHOD

This study uses qualitative research, with descriptive methods. The descriptive method is a procedure for solving problems by describing the state of the subject or object of research based on visible facts, without engineering (Creswell, 2013). The variables studied were student perceptions in terms of the aspects of mathematical disposition and mathematical resilience. The population is students who take part in "Numbers and Algebra" learning. Samples were taken randomly or random sampling. The subjects chosen later are several students who show indications of problems with disposition and resilience. Data collection techniques used are interviews, observation, and documentation studies. Interviews and observations are ways to obtain data about student perceptions, while documentation is used to obtain supporting data related to student academic background. Questions are arranged based on aspects of mathematical disposition and resilience, namely the responses or feelings of students as research subjects. The data analysis used is the Miles and Huberman model with the validation of drawing conclusions through triangulation of interview, observation and documentation methods.

IV. RESULT AND DISCUSSIONS

The Numbers and Algebra course for Elementary Schools is designed so that students have a basic mastery of numbers and arithmetic operations as part of basic math skills. As with other PGSD courses, learning is carried out as a prerequisite for taking the next course. It would be very unfortunate if students could not master mathematics both in terms of cognitive, affective and psychomotor. The three aspects complement each other and go hand in hand. One of the affective or attitudes towards mathematics is a determinant of the success of learning. When students are positive. then learning activities will be carried out with enthusiasm. Talking about the affective aspects of mathematics, there are two main topics in this study, namely mathematical disposition and mathematical resilience. Based on the definition that has been synthesized by the researcher, it means that a mathematical disposition is a positive tendency towards mathematics. Meanwhile, resilience is related to the attitude of students in facing, overcoming, being strong when facing obstacles and obstacles in the learning process.

Through a qualitative study conducted by researchers regarding student perceptions in learning Numbers and Algebra at PGSD Sanata Dharma University, several observations were found for each aspect of mathematical disposition which can be generalized in table 1.

Table 1 Observation Results of Student Perceptions from a Review of Mathematical Disposition and Resilience

Observation Aspect	Observation Notes
Students look happy and enthusiastic in participating in algebra lectures	Based on observations, the enthusiasm of students can be seen from their sitting position. The students who sat in front looked more enthusiastic than those behind. They also actively respond when asked questions by the lecturer.
Student response to learning activities (related to learning models)	The learning model used by lecturers is an interactive model. It can be seen that lecturers always provide opportunities for students to build their own knowledge first. Several students responded well
Students look confident in following and solving questions from the lecturer	It can be seen that the majority of students lack confidence in expressing opinions. Must be given a stimulus first. However, when there was stimulation in the form of questions, students indicated they were trying to be confident.

Students show a high curiosity attitude during lectures	Most students immediately seek information when given assignments by lecturers. This can be seen when given the task of finding information about "what is AKM?" students immediately search for information through their respective gadgets. But when asked, some of them have not been able to capture the information properly.
Students give appreciation for what they have learned	Appreciation is carried out by lecturers and students at the end of learning by confirming what has been learned in class that day.
Students gave positive responses to the learning activities they participated in	Students give a positive response to lecture activities, by answering questions given by lecturers.
Students try to complete the challenges given by the lecturer	In the first meeting as an introduction to the material, students were asked to find information about AKM. Students try to dig up the information. But when it was confirmed there were those who had not found any information.

In addition to the results of the documentation study, interviews were also conducted with the lecturers of the Numbers and Algebra course which lead to several aspects of mathematical disposition and resilience. The results of the interview activities can be generalized in table 2.

Table 2 Student Perception Interview Results from a Review of Mathematical Disposition and Resilience

Question Items	Analysis of Answers
In your opinion, do students think that algebra courses are difficult and scary?	For elementary number and algebra material it's actually not difficult, because you only study elementary material. What becomes difficult or a scourge is how students/prospective teachers introduce this material to students. Because what we learn is the basic concept.
How many students enjoy this course?	Relatively many people like it, but usually students are constrained in the final result. Because the mathematical concept is not quite right so the value is not satisfactory.
Are students enthusiastic about attending lectures? If not, why did it happen?	The majority of students look enthusiastic when participating in learning.
In your opinion, do students have confidence in completing assignments, either individually or in groups? If so, what is the evidence? If not, why did it happen?	Regarding student self-confidence, they are divided into two, namely self-confidence in class and assignments as well as self-confidence in exams. Students tend to lack confidence when there is a quiz or exam.
Have students used a different method (exploration) than that taught by you when teaching to find an answer? And is the result the same?	This depends on the problem given. For example, the exploration of ideas appears when there is a stimulus regarding the question "opinion", otherwise students tend to follow what has been taught.
Do you think algebraic mathematics has been applied in everyday life by students?	Yes, all mathematical concepts are very close to our lives. So far what has been observed for numbers and algebra courses, numbers are better known and often used in everyday life.
How is the student's curiosity about the material presented? (Indicators: often ask questions, look for other references, prepare materials before lectures)	Students' curiosity when learning really needs to be given a stimulus. Incidentally the class that I teach is semester 2, they tend not to have a sense of competitiveness and lack of curiosity.
Have you ever tried to explore ideas on students related to mathematical concepts?	The current obstacle for students, in my opinion, is the lack of courage in conveying ideas. So, they are too comfortable with the pandemic (online learning). Where when zooming or online meetings tend to receive one-way information. So it affects habits.

Do students like to solve problems that are more difficult than those exemplified? (challenge)	Students prefer simple questions such as multiple choice. Even during their exams, many of them asked to take home, from here it seems that the brand doesn't like challenges.
If given a more difficult problem, do students try to solve it first using their own way or ask the teacher directly?	Yes, they try to finish first. There are also those who wait for their friends or ask me directly (but rarely) they will be comfortable asking friends.
In your opinion, are students able to appreciate mathematics?	The appreciation given by the lecturer is in accordance with the capacity of the student. However, the appreciation given by students can be in the form of completing assignments on time and optimally.
In your opinion, do students often feel hopeless when they receive difficult math assignments?	There is, and it happens often. In my opinion, students' despair does not mean they are angry or lazy, but it is also indicated when students answer questions perfunctorily, not optimally. The important principle is to collect.
In your opinion, what is the student's response to the algebra course?	The majority of students gave positive responses such as doing their assignments well, but not a few also gave less positive responses because of the difficulties they faced.

The data analysis process was carried out through several stages which included data collection, data reduction, data presentation, and drawing conclusions/verification. Three stages of analysis have been carried out by researchers with the presentation of the data that has been described. Next is the stage of verifying the results of the analysis, in this case the researcher uses the source triangulation technique which can be described as follows.

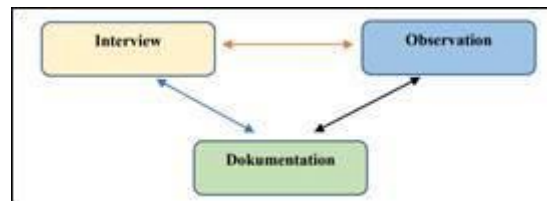


Figure 1. Source Triangulation (Sugiyono, 2013)

Based on the results of the data analysis previously presented, there are several aspects of mathematical disposition and resilience that are supported from three data sources obtained by the researcher. However, in this discussion sub-section will be analyzed from each aspect of the two variables.

High curiosity, as one aspect of a mathematical disposition. It is known that from the results of interviews which state that curiosity is also influenced by the semester level and the competitive spirit of students which in this case is considered to be lacking. From the observation results it can also be seen that the stimulus provided by the lecturer received minimal response, for example when given the opportunity to ask or respond, it can be said that only 1 out of 10 students gave a response. So, it is verified that the curiosity aspect of students needs to be improved. Attention and interest in learning mathematics which is marked by focus and showing expressions of pleasure in learning mathematics. Awe & Benge (Awe & Benge, 2017) states that the interest that exists in the learner is closely related to the motivation he has. Based on the results of observations, it appears that students always pay attention to explanations and follow lectures carefully. This is proven through the documentation of activities that capture students playing mobile games. However, only a small portion can be said to pay less attention. In accordance with the opinion of Awe & Benge, the low interest of a small number of students is indicated by their low motivation to study.

Perseverance which is characterized by persistence, never giving up, apart from being part of a mathematical disposition, being diligent is also included in the aspect of resilience. This aspect was observed through observation, as evidenced by the documentation of learning activities and confirmed in interviews, that students actually have persistence, when they are given assignments or quizzes. It can be seen that during the first lecture meeting, students were given the assignment to find information about the Minimum Competency Assessment (AKM). They did not wait long for students to immediately look for this information and record it.

In contrast to the previous aspects, aspects of self-confidence which are characterized by confidence and courage in solving mathematical problems and expressing opinions need to be marked in this study. Providing stimulus by lecturers with the aim that students participate actively in expressing opinions, although some have ventured but the majority have not shown positive value from this aspect. Actually, curiosity and self-confidence have a correlation. High curiosity affects self-confidence and vice versa (Noviyanto, 2021). So, because there is an indication of curiosity that must be increased, aspects of self-confidence also need to be paid attention to.

As part of the meaningfulness of what has been learned in mathematics, an attitude of respect for mathematics that can be shown by the application or use of mathematics in everyday life is important for students to have, in resilience it is referred to as a positive response aspect. Although this aspect was not directly observed in observation activities, it was confirmed in interviews with the statement "mathematics is very close to our lives". So, indirectly students are able to give an appreciation of mathematics. Appreciation is not only related to utilization, but also related to students' responses after learning mathematics.

Slightly different from self-confidence in the aspect of mathematical disposition, self-confidence in resilience is interpreted as self-confidence that one is able to learn mathematics. Nonetheless, the two are intertwined. Self-confidence can be observed when students begin to show self-confidence. Amri stated that self-confidence is a self-confidence. Students who are confident in their abilities will try to dare to convey their thoughts. It is unfortunate that this aspect of self-confidence is less visible during the research process, due to the lack of student self-confidence (Amri, 2018).

The last aspect of mathematiccal resilience is persistence or never giving up in solving problems related to mathematics. Anditiasari states that the attitude of never giving up in solving math problems can be seen from the way students answer questions (Anditiasari, 2020). This was confirmed in the interviews that some students took the exams in a rudimentary manner, were not optimal and had the principle that it was important to collect. From this it can be seen that, there are two indications, namely the attitude of giving up or indeed his abilities are different from his friends. However, the attitude of giving up will not appear when students try to study diligently, persistently, confidently and have high curiosity. So, the attitude of resilience or resilience possessed by students in Numbers and Algebra courses needs to be a concern.

V. CONCLUSIONS

Mathematical disposition and resilience as affective aspects or attitudes towards mathematics should be owned by every learner. Because it cannot be denied that success in learning mathematics is determined by several factors, both from cognitive knowledge acquired and affective or positive attitudes to the application of mathematics in everyday life. This is in accordance with the objectives of the existence of mathematics learning. Based on the results of the analysis and verification that has been carried out, there are several conclusions from this study which are students' perceptions of mathematics, especially in the Numbers and Algebra courses in terms of both variable aspects. The majority of aspects of disposition and resilience are owned by students, it's just that a few notes as a result of the findings of this study are: 1) Factors that influence students' attitudes towards mathematics can be caused by early learning motivation, 2) Attitudes towards mathematics are related to activities and student learning outcomes, 3) Aspects of mathematical disposition that need to be optimized are self-confidence and curiosity, 4) Aspects of mathematical resilience to note are confidence and resilience. Through this research it is hoped that it can become a recommendation material for emphasizing affective aspects that must be instilled in students. This research has limitations, namely the scope or scope of the research. Because this research is perceptual in nature and limited to students who take the Numbers and Algebra class.

VI. RECOMENDATION

The limitation of this research is in the scope of the research, which is limited to elementary school teacher education students. So, the recommendation for further research is to broaden the scope so that it can be generalized. In addition, this research can be used as a recommendation for further research related to similar subjects and variables.

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