



## Analysis of Students' Mathematical Disposition Ability in Online Mathematics Learning During the Pandemic

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### ABSTRACT

Mathematical disposition ability is a strong will from within students to learn mathematics so that students can solve mathematical problems. This ability is important for students because it can support their understanding of solving mathematical problems. This study analyzed students' mathematical disposition abilities in online learning mathematics during the pandemic. This research is quantitative descriptive research with the type of survey research. The research subjects were grade 11 science and social studies students at Mutiara Harapan High School, totaling 30 students. Data collection techniques used questionnaires distributed through google forms and interviews. The data analysis technique used descriptive statistics. The result is that the first 4 indicators of mathematical dispositional ability are in the high category with percentages of 72%, 79%, 75%, and 70%, respectively. The other 3 indicators are in the very high category, with percentages of 84%, 89%, and 84%, respectively. Overall, students' mathematical disposition during the pandemic was in the high category, with an average percentage of 79%. The mathematical disposition of students in the high category shows that students have self-confidence, flexibility, perseverance, curiosity, reflection on work results, and appreciation and apply the role of mathematics in everyday life.

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### INTRODUCTION

The government officially announced that the Coronavirus (SARS-CoV-2), better known as COVID-19, entered Indonesia in March 2020. This had a significant impact on several fields. One of the areas affected is education. The government has taken many steps to stop the spread of the COVID-19 virus. One of the policies taken by the government to suppress COVID-19 cases is to issue a ban on face-to-face learning, as stated in the Circular of the Minister of Education and Culture of the Republic of Indonesia No. 3 of 2020 [1]. Based on the circular, all levels of education must carry out online learning. This is done so that students get maximum learning during the pandemic, even though it is not done face-to-face.

Online learning is learning that is done online by utilizing the internet network. This is in line with the statement of [2], which states that online education requires an internet network with accessibility, flexibility, and the ability to generate various learning interactions. Through online learning, students are trained to be independent and not dependent on others. This is because, through online learning, students will focus on completing assignments and ongoing discussions. Therefore, it is hoped that online learning makes students more independent and can construct their knowledge [3].

Handarini and Wulandari stated that online learning must be supported by adequate facilities

and infrastructure such as computers, laptops, smartphones, and internet networks [4]. In addition to these facilities, online learning must also use a platform to help the learning process. The government, through the official website of the Indonesian Ministry of Education and Culture, suggested 12 platforms that can be used to support online learning, namely (1) learning houses; (2) Our table; (3) I can do; (4) Indonesia; (5) Google for education; (6) Smart Class; (7) Microsoft Office 365; (8) Quipper school; (9) Teacher's room; (10) Your school; (11) Zenius; (12) Cisco Webex.

Changes in the learning process require teachers and students to adapt quickly to the new learning process during this pandemic. The government chose online learning during the pandemic because it was considered effective as a substitute for face-to-face learning. The existence of online learning is expected to train students' independence in learning. Time and place are also very flexible in online learning. However, Hendri states that the negative impact of online learning can lead to reduced student focus on learning and lead to frustration, anxiety, and confusion [5]. This can affect the ability of students' mathematical disposition.

Disposition is one of the factors that influence the success of learning. A strong disposition, tenacity, responsibility, motivation, high achievement, and helping individuals achieve their best results [6]. In essence, learning mathematics does develop not only cognitive aspects but also affective aspects. An important aspect of the affective domain that influences is the positive view of students towards mathematics or also known as mathematical disposition. Students need disposition because it will help them be more persistent in facing challenging problems, be responsible for their learning, and develop good habits in mathematics [7]. Melinda states that students need mathematical disposition skills to survive problems, take responsibility for learning, and develop good study habits [8]. In addition, with good mathematical disposition skills, students will tend to think and act positively, have self-confidence, curiosity, perseverance, enthusiasm for learning, persistence in facing mathematical problems, and flexibility.

In mathematics, a disposition is related to students' views on solving mathematical problems [9]. In the process of solving mathematical problems, the attitudes that students must possess include being critical and careful, objective and open, appreciating the beauty of mathematics, and being curious and happy to learn mathematics. This attitude will essentially shape and grow a mathematical disposition, namely a strong desire, awareness, and dedication in students to learn mathematics and carry out various mathematical activities [10]. From the explanations of the experts above, it can be concluded that the ability of mathematical disposition is a strong will from within students to learn mathematics so that students can solve mathematical problems. For this reason, students' mathematical disposition skills need to be considered during online learning.

Online learning that lasts for a long time has a very strong effect on students. Apart from teachers, students are also required to be able to adapt to the new learning system that they have to face. Apart from teachers, students are also required to be able to adapt to the new learning system that they have to face. At first, it was not only students, teachers also had difficulty implementing a new learning system during the pandemic to maximize student understanding. The many obstacles, such as learning media, internet networks, etc., become obstacles to online learning that cannot be fully understood. Based on the results of a preliminary study, several students of the Mathematics Education Study Program from different semesters revealed that the online learning they participated in was not optimal because the interactions that occurred during online learning were not satisfactory for those who were active in class. In contrast, for some, those who lack the courage to express opinions in online learning classes make them more confident and courageous in expressing opinions.

In contrast, others reveal that understanding mathematics material in the online learning process is more difficult [11].

According to NCTM, some of the main components in the ability of mathematical disposition are (1) Confidence in solving mathematical problems, communicating ideas, and giving reasons, (2) Flexibility in exploring mathematical ideas and trying various things. Alternative methods for solving problems, (3) Strong determination to complete mathematical tasks, (4) Interest, curiosity, and ability to find in doing mathematics, (5) Tendency to monitor and reflect on one's thinking process and performance, (6) Assess the application of mathematics in other fields and everyday life and (7) Appreciation of the role of mathematics in culture and its value, both mathematics as a tool, and mathematics as a language [12]. The indicators of mathematical disposition ability used in this study refer to indicators following the NCTM. The statement items in the mathematical disposition questionnaire were developed following the indicators from the NCTM. Based on the description that has been stated, the purpose of this study is to analyze students' mathematical disposition skills during online learning during the COVID-19 pandemic.

## METHODS

This research is quantitative and descriptive. The research subjects were class 11 science and social studies students at Mutiara Harapan High School, with as many as 30 students. The research sample was selected randomly, consisting of 12 male and 18 female students. Data collection techniques were obtained through questionnaires distributed through the google form platform and interviews. The questionnaire is closed so that respondents can choose from the answers provided. The questionnaire was prepared by developing indicators of mathematical disposition ability. The data analysis technique used is descriptive statistics. Descriptive statistics are part of statistics regarding data collection, presentation, and determination of statistical values, making diagrams or pictures about something in a form that is easier to understand [13]. Researchers describe the problem from the results of the questionnaire filled out by the respondents and based on the results of interviews. The assessment technique used is the Likert scale with a rating scale from 1 to 4, as shown in Table 1 below.

Table 1. Scoring Scale

Answer Scale	Positive Statement Score	Negative Statement Score
Very Agree	4	1
Agree	3	2
Less Agree	2	3
Disagree	1	4

Resources: [14]

The category of the level of mathematical disposition used in this study refers to the modification of [14], as shown in Table 2 below.

Table 2. Category of Mathematical Disposition Level

Interval	Criteria
$0% < x \leq 20%$	Very Low
$21% < x \leq 40%$	Low
$41% < x \leq 60%$	Medium
$61% < x \leq 80%$	High
$81% < x \leq 100%$	Very high

Resources: [14]

## RESULTS AND DISCUSSION

This research was conducted online using the Google Forms platform. It begins with distributing closed questionnaires so respondents can choose the answers provided. The researcher distributed a questionnaire containing 40 positive and negative statements to the students of grade 11 science and social studies at SMA Mutiara Harapan, totaling 30 students. Statement items 1-9 are the development of self-confidence indicators. Statements 10-13 development of flexible indicators. Statements 14-18 development of indicators of strong determination in completing mathematical tasks. Statements 19-25 of developing curiosity indicators, statements 26-31 of development indicators of a tendency to monitor and reflect on their thinking processes and performance, statements 32-36 of developing mathematical application indicators, and statements 37-40 of developing indicators of mathematics appreciation.

The questionnaire used uses a Likert scale with four choices, namely strongly agree (SS), Agree (S), Disagree (KS), and Disagree (TS). The highest value is 4 in a positive statement if the respondent chooses Strongly Agree, while in a negative statement, the value is 4 for Disagree. This is in line with the statement of [15] that each item on the Likert scale must be positive and negative by paying attention to the object of his attitude. The results of the average mathematical disposition ability indicators based on the results of the questionnaires that have been distributed are shown in Table 3 below.

Table 3. Results of Calculation of the Mathematical Disposition Questionnaire

No	Indicator	Average	Category
1	Confidence in solving math problems, communicating ideas, and giving reasons for results of Calculation of the Mathematical Disposition Questionnaire	72%	High
2	Flexibility in exploring mathematical ideas and trying various alternative methods to solve problems	79%	High
3	Determined to complete math tasks	75%	High
4	Interest, curiosity, and ability to find in doing math	70%	High
5	Tendency to monitor and reflect on one's thought processes and performance	84%	Very High
6	Assess the application of mathematics in other fields and everyday life	89%	Very High
7	Appreciation of the role of mathematics in culture and its value, both mathematics as a tool and mathematics as a language	84%	Very High

Based on the analysis of each indicator of the mathematical disposition questionnaire that has been collected, the average for the first indicator is 72% in the high category. . The first indicator relates to students' confidence in solving math problems, communicating ideas, and giving reasons. This means that students have confidence that they can do math problems, dare to answer the questions given, are optimistic about solving challenging questions, and are active in learning. Based on the results of interviews related to the first indicator, most students dare to try to work on the math problems given and are not shy to ask friends or teachers if they find difficulties during the completion process. In line with the results of Hamidah and Prabawati's research (2019), which also obtained a high category, the first indicator, was by several students who dared to solve the problems given, dared to share opinions, rebuttals or questions when discussing and were optimistic that they could solve math problems [16]. Self-confidence means that students have confidence in themselves, feel confident in their abilities, and can accept and respect the opinions of others. Students with high self-confidence also tend to increase their capacity by trying new things.

In the second indicator, the average obtained is 79% and is still in the high category. The second indicator relates flexibility in exploring mathematical ideas and trying various alternatives to solve problems. This means that students like to find solutions from various sources and ways of solving them to explore other concepts related to learning topics. Based on the results of the interviews, the reasons for students working in various forms were so that they could choose a more effective method to use. The high percentage in indicator 2 is indicated by students filling out worksheets in their language and way, enthusiasm for finding other solutions if they encounter obstacles, and being able to accept different opinions from their friends [16].

The third indicator is a strong determination to complete mathematical tasks. In the third indicator, the average obtained is 75% in the high category. This means that students are optimistic about solving challenging math problems and keep learning even though they are not given assignments. The results of the interviews showed that the reason students continued to study even though there were no assignments was so that they could remember and understand more about the material that had been previously studied. In addition, students think that repeating lessons at home can help them more easily understand advanced lessons. In another study, the high category in the third indicator was seen in the attitude of students who kept trying to continue the process of solving higher-order thinking skills (HOTS) questions. Being diligent in doing the math will provide benefits, namely training in mathematical thinking, solving math problems on time, and training to be thorough and not careless.

Next is the fourth indicator, namely interest, curiosity, and ability to find in doing math problems. In this indicator, the average obtained is 70% and is still in the high category. This means that students are interested in participating in mathematics learning, keep practicing even though there are no assignments, find out mistakes in their work as a reflection for the future, and always try to solve the given math problems. The interviews showed that students were interested in taking mathematics lessons in the fourth indicator because the lesson flow was systematic. In addition, students feel certain because the answers that will be obtained will remain the same even though they use various solutions. Students like to be free to use various ways to solve the problems given, so they are not fixated on one method.

The fifth indicator relates to the tendency to monitor and reflect on one's thinking process and performance. The average obtained for this indicator is 84% in the very high category. This means that students are responsible for the task, always reflect on previous learning as a basis for the next topic and focus during learning. The interviews showed that students felt restless if they did not complete the task. Students stay focused so that the understanding gained can be deeper so that they can solve questions that have different shapes but still use the same concept. Research relevant to the fifth indicator is in line with research by [16] that students will try to solve math problems or assignments even though there are many. Then after completing the math problems or assignments, students do not forget to re-check the answers they have obtained.

The sixth indicator assesses the application of mathematics in other fields and everyday life. At this level, the average obtained is 89%, with a very high category. This means that students have fully felt the benefits and role of mathematics in everyday life and can relate mathematics to other subjects. From the interviews, students stated that they encountered many applications of mathematics in everyday life, from simple problems to complex problems. In addition, mathematical concepts are also used in other subjects such as biology, chemistry, physics, and economics.

The last indicator is the appreciation of the role of mathematics in culture and its value, both



as a tool and as a language. The average obtained is 84% in the very high category, meaning that students think mathematics helps them to be more careful in doing calculations and helps them express and explain data. This is supported by student statements from the interviews, which state that mathematics can help them when making presentations in front of the class. The existence of graphs, tables, and diagrams makes the data easier to understand.

Based on the description above, the average for all indicators of mathematical disposition ability is 79% in the high category. This means that students have self-confidence, flexibility, perseverance, and curiosity, reflect on work results and appreciate and apply the role of mathematics in everyday life. In line with research conducted by Fauziah et al. [17], that mathematical disposition influences students' problem-solving abilities. This happens because the indicators of mathematical disposition help students to be able to think broadly so that students can construct their knowledge and can solve mathematical problems. Supporting Fauziah's research results [17], [18] also obtained the same results by researching students' mathematical disposition abilities, beginning with giving a questionnaire containing questions to measure students' mathematical disposition abilities, followed by providing problems to measure students' problem-solving abilities. Some of the factors revealed by [7] as the cause of the high and low ability of students' mathematical dispositions are (1) students' basic mathematical abilities, (2) the approaches and methods that teachers use, and (3) learning conditions, interests and talents of students. These three things significantly affect the ability of students' mathematical dispositions.

Another relevant research is the results of Anita's research that the ability of mathematical dispositions has a positive influence on the ability to understand mathematical concepts due to the tendency to think and act positively in students, which is manifested in the form of high self-confidence, perseverance, and enthusiasm when solving mathematical problems [19]. According to [19], the factors influencing students' mathematical disposition abilities are divided into internal and external factors. According to the researchers, in this study, the biggest factors came from external factors, namely educators and learning models used in the classroom. The role of educators in choosing suitable and interesting learning methods greatly influences students' learning process, especially in understanding students' mathematical concepts.

Ringga conducted the same research, analyzing students' mathematical disposition abilities during online learning and obtaining results in the moderate category [11]. This shows a perception when learning mathematics online that students have low interest and curiosity in mathematics and are more flexible in solving mathematical problems. This is slightly different from the results obtained in this study. Melinda obtained results in the good category for analyzing student abilities during online learning [8]. Rizki's research obtained the same results as this study. Research that analyzes students' mathematical disposition abilities during online learning obtains results in the high category [20]. This is due to the selection of effective applications for online mathematics learning. The acquisition of a high category in mathematical disposition abilities means that the students who are the subjects of this study already have good mathematical disposition abilities during online learning during the pandemic.

## CONCLUSIONS AND SUGGESTIONS

Based on the results and discussion, it can be concluded that online learning affects students' mathematical disposition abilities. The first 4 indicators of mathematical disposition ability are in the high category, with percentages of 72%, 79%, 75%, and 70%, respectively. The other 3 indicators are

very high, with percentages of 84%, 89%, and 84%, respectively. Overall, students' mathematical disposition during the pandemic was in the High category, with an average percentage of 79%. The mathematical disposition of students in the high category shows that students have self-confidence, flexibility, perseverance, curiosity, reflection on work results, and appreciation and apply the role of mathematics in everyday life. Suggestions for further research development can analyze other students' abilities during online learning, considering that students have not done face-to-face learning for a long time.

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