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MATHEMATICAL DISPOSITION ANALYSIS OF ELEMENTARY SCHOOL STUDENTS ON THEIR MATHEMATICAL PROBLEM-SOLVING SKILL

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ANALISIS DISPOSISI MATEMATIS SISWA SD TERHADAP KEMAMPUAN PEMECAHAN MASALAH MATEMATIKANYA

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ABSTRACT

Abstract: *The role of students' attitudes (disposition) towards mathematics is an important element in solving their mathematical problems and must be maximized properly. Disposition has the following indicators such as self-confidence, flexibility, persistence, curiosity, reflecting, and applying it. This paper describes the elementary students' mathematical disposition profile toward their problem-solving skills. The research method uses qualitative-descriptive. Data were collected through questionnaires, observations, and interviews, which were subsequently analyzed by triangulation technique. The results indicate that there is a significant relationship between elementary school students' mathematical dispositions and their problem-solving skills. Students who achieve the "excellent" category of mathematical disposition indicators (mathematical disposition indicators score > 85%) have good problem-solving skills. Furthermore, students who are categorized as "less" (mathematical disposition indicators score < 60%) have problem-solving skills and need treatment. The analysis results that were obtained through questionnaires, observation, and confirmation with interviews indicate that the students' mathematical disposition skills in group A were categorized as excellent with disposition indicators of 95%. Students' mathematical disposition in group B was categorized as quiet good with the students' mathematical disposition criteria of only 65%. In addition, students' mathematical disposition in group C was categorized as less good because students' mathematical disposition skills appear only 65%.*

Keywords: students' mathematical disposition, mathematical problem-solving skill

Abstrak: Peran sikap (disposisi) siswa terhadap matematika merupakan unsur penting dalam pemecahan masalah matematika mereka dan harus dimaksimalkan dengan baik. Disposisi memiliki indikator seperti percaya diri, fleksibel, gigih, ingin tahu, merenung, dan menerapkannya. Tulisan ini mendeskripsikan profil disposisi matematis siswa SD terhadap kemampuan pemecahan masalah. Metode penelitian menggunakan kualitatif-deskriptif. Data dikumpulkan melalui angket, observasi, dan wawancara, yang kemudian dianalisis dengan teknik triangulasi. Hasil penelitian menunjukkan bahwa terdapat hubungan yang signifikan antara disposisi matematis siswa sekolah dasar dengan kemampuan pemecahan masalahnya. Siswa yang memenuhi indikator disposisi matematis kategori "sangat baik" (skor indikator disposisi matematis > 85%) memiliki kemampuan pemecahan masalah yang baik. Selanjutnya, siswa yang dikategorikan "kurang" (skor indikator disposisi matematis < 60%) memiliki kemampuan pemecahan masalah yang memerlukan perlakuan. Hasil analisis yang diperoleh melalui angket, observasi, dan konfirmasi dengan wawancara menunjukkan bahwa kemampuan disposisi matematis siswa kelompok A tergolong sangat baik dengan indikator disposisi yang muncul sebesar 95%. Disposisi matematis siswa kelompok B dikategorikan cukup baik dengan disposisi kriteria yang terlihat hanya 65%. Selain itu, disposisi matematis siswa kelompok C dikategorikan kurang baik karena hanya muncul 30%.

Kata Kunci: ***disposisi matematis siswa, kemampuan pemecahan masalah matematis***

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INTRODUCTION

Learning mathematics is related to problem solving ability and is an important element for each student in elementary school. Mathematics problem solving is a subject that is considered difficult and has its own challenges, both cognitively and emotionally (Jiang et al., 2021). Cognitively, solving math problems effectively involves a variety of skills such as the ability to understand numbers (Sutama et al., 2021), apply basic math facts (Callingham & Siemon, 2021), mathematical reasoning (Suryaningrat et al., 2021), and activate relevant prior knowledge (Wu et al., 2021). Emotionally, solving complex mathematical problems will affect students' psychological condition both positively and negatively (Raccanello et al., 2019). The positives are as follows: curiosity, pleasure, and pride; whereas negatively such as: frustration, anxiety, and boredom (City, 2021).

Problem solving ability cannot be obtained by students without maximum effort from themselves. Personal support for learning mathematics is the most important aspect in improving problem solving skills. Some students are not interested in learning mathematics because there is no motivation to learn. Students consider mathematics a boring subject because they have to understand difficult and many mathematical formulas (Mariamah et al., 2021). This condition will affect students' problem solving abilities which are needed even in their daily lives (Munafiah et al., 2023).

The initial study results showed that most elementary school students in one school were unable to solve problem-based questions. This shows that students' understanding in identifying a question is still experiencing problems. Students are impressed without thinking long to analyze and provide direct answers (to the point). As a result, their answers are wrong. This condition affects students cheating on other friends because it is considered more practical. This finding is supported by the statements of their subject and classroom teachers that many students feel apathetic about mathematics, lack curiosity, and are not enthusiastic about mathematics.

Students who have good problem solving skills will have good mathematical disposition (Ulia & Kusmaryono, 2021), including: liking mathematics, appreciating mathematics beauty, having high curiosity and enjoying learning mathematics (Irawan & Iasha, 2021). Thus, students are expected to be able to develop mathematics continuously and use to solve problems experienced in their lives.

Students' mathematical disposition towards mathematics will appear when students complete math tasks such as: working with confidence, being responsible, diligent, never giving up, feeling challenged, and willing to find other solutions and reflecting on the way of thinking that has been done (Cahyaningsih & Nahdi, 2021). This is in line with the National Council of Teachers of Mathematics (NCTM) which states that mathematical disposition contains indicators that are adapted to the cognitive development of elementary school children which are included in the intuitive and concrete operational stages (Minarti et al., 2020). The indicators are as follows: (1) Confidence in using mathematics to solve problems. Confidence contains student's positive and optimistic attitude of towards their ability to solve problems; (2) Flexibility in trying various ways to solve math problems. Students must have a tendency to think flexibly and try various strategies in solving math problems; (3) Persistent in completing math tasks.

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Persistence is an unyielding attitude in working on complex and difficult math problems; (4) Full of curiosity in doing mathematics and exploring various mathematical problems; (5) Have a tendency to monitor and reflect mathematical work results; and (6) Appreciate mathematics application in everyday experiences (Suhaedi et al., 2020).

Based on affective domain assessment of Indonesian curriculum, it is known how important to improve mathematical disposition in teaching and learning process. Students' mathematical disposition can be seen from the students' desire to change strategies, reflect, and conduct analysis to obtain a solution (Yaniawati et al., 2019). Students' disposition towards mathematics can be observed in class discussions. For example, how much students want to explain the mathematics solution they use and defend it. Based on this description, a more in-depth mathematical disposition analysis of elementary school students is needed to determine the ability effect to solve problem. In the future, these results can be used as a reference for mathematics teachers in elementary schools in solving the same case, therefore students are no longer phobic with mathematics.

RESEARCH METHOD

Research Design

This research uses a qualitative approach with a case study design. Creswell et al., (2007) explains that the case study design is focused on a phenomenon that is chosen to be studied in depth by ignoring the others. Such phenomena are: a school principal or education leader, programs, a process, a policy implementation, a concept, and a group of students. The group under study is a socio-cultural unit that is natural and interacts individually or in groups. Sometimes the groups being studied are sub-groups that are unique or different from the size of the group, very slow classes, subjects that students don't like so that learning achievement is low, groups of students who show abnormalities, and so on. Based on this description, this research design refers to Stake (Creswell et al., 2007) and Creswell (Campbell et al., 2020) as shown in Figure 1 below.

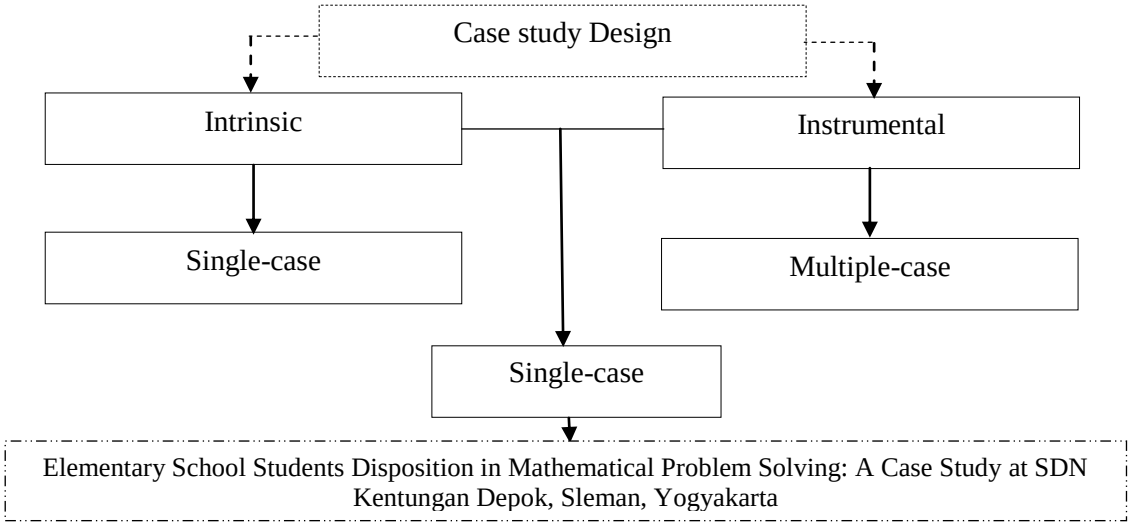

Figure 1. Stake and Creswell case study design

Figure 1 shows that the student's case at SDN Kentungan selected as an instrument to prove the concept or researcher theory. This study examines and analyzes an interesting issue related to elementary school student's disposition in solving math cases.

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Participants

This study involved 35 people in class VI and selected by purposive sampling technique. This technique is used by considering certain characteristics according to the purpose (Barrett & Twycross, 2018). The characteristics are as follows: the school quality is categorized as average (medium), the students' heterogeneity mathematical abilities (high, medium, and low criteria), and the admission selection process is not strict.

Data collection

Data was collected through structured interviews about students' mathematical dispositions, student observation sheets during problem solving, and students' mathematical disposition questionnaires. The details are as follows:

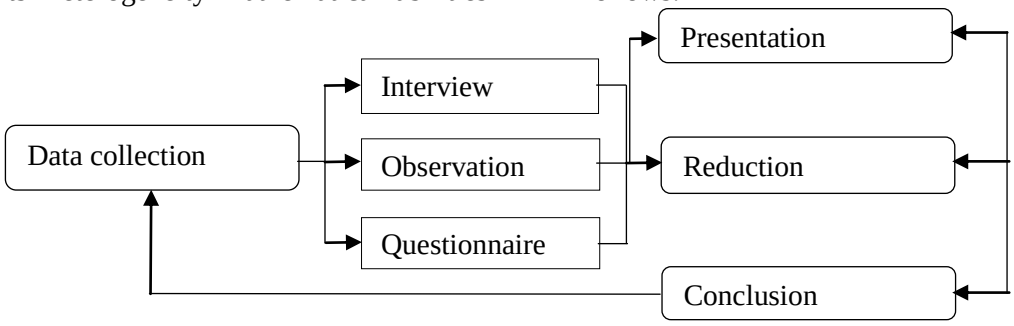

Figure 2. Data collection techniques (Snyder, 2019)

Figure 2 shows the flow of research data collection carried out. Data was collected through interviews, observations, and questionnaires to analyze students' mathematical dispositions based on each indicator. Furthermore, the data obtained are presented and described by referring to important data to conclude. The data presented are related to the mathematical disposition indicators of elementary school students. The indicators are as follows.

Table 1. Mathematical disposition indicators profile

No	Mathematical disposition indicators
1	Self-confident
2	Flexibility
3	Persistent
4	Curiosity
5	Reflecting
6	Apply it

Data analysis

The data obtained were coded and analyzed. Triangulation technique is used to test the credibility as well as confirm the validity obtained based on observations, questionnaires, and interviews (Campbell et al., 2020). Valid data are discussed to show findings related to each indicator of students' mathematical disposition. The analysis results are presented in the form of three groups of students' mathematical disposition abilities, namely A: (observation average score≥ 85%), B: (60% ≤ observation average score ≤ 85%, and C: (observation average score ≤ 60%). Whether or not of each indicator ability appears in this case depends on the observation percentage score results. While the questionnaire data is analyzed by Mean

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Distance from Optimal (MDO) with categories as shown in Table 2. Finally, the researcher confirms the results suitability of the observations and questionnaires through interviews to strengthen the findings obtained.

Table 2 Students' mathematical disposition abilities criteria
(Oppermann & Lazarides, 2021)

Questionnaire Score	MDO	Criteria
3,26 ≤ MDO ≤ 4,00		Excellent
2,51 ≤ MDO ≤ 3,25		Quiet Good
1,76 ≤ MDO ≤ 2,50		Less Good
1 ≤ MDO ≤ 1,75		Not Good

RESULTS

This study analyzes the findings related to the mathematical disposition of elementary school students towards their ability to solve problems. The analysis results then become a reference in describing each indicator achievement of the mathematical disposition. The achievement profile of each indicator is grouped into three criteria referring to the questionnaire data, namely groups A, B, and C as shown in Table 3 below.

Table 3. Students' mathematical disposition abilities profile

Disposition indicators	Questionnaire	Observation	Interview
Group A			
Self-confident	Excellent (MDO score: 3,57)	Number of students observed: 95%	Consistent
Flexibility			
Persistent			
Curiosity			
Reflecting			
Apply it			
Group B			
Self-confident	Quiet good (MDO score: 2,73)	Number of students observed: 65%	Consistent
Flexibility			
Persistent			
Curiosity			
Reflecting			
Apply it			
Group C			
Self-confident	Less Good (MDO score: 1,80)	Number of students observed: 30%	Consistent
Flexibility			
Persistent			
Curiosity			
Reflecting			
Apply it			

Table 3 shows that group A has a level of mathematical position that has excellent criteria, seen based on the average score of the questionnaire (MDO) = 3.57. These results are supported by observational data where as many as 95% of students' mathematical disposition indicators are identified. This is also found to be consistent with the results of interviews with students. Interviews were conducted to confirm the suitability of the data obtained through questionnaires and observations. These results indicate that

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students in group A are able to understand the problem well; can use or develop problem solving strategies; flexible in solving problems; and students are able to explore and plan solutions appropriately.

In general, students in group A already have good mathematical disposition skills. Although students say that mathematics is a difficult subject, they are still enthusiastic about learning it. This finding is supported by Oppermann and Lazarides (Azmidar et al., 2017) that students who are interested in learning mathematics tend to choose mathematics subjects, are more persistent in doing difficult tasks, and show high levels of performance. Students who are able to solve math problems well in line with their motivation and beliefs to solve problems, define, explore, plan, work on, re-correct, and generalize (Cui et al., 2021).

Table 3 also shows the profile of students' mathematical disposition abilities with quiet good criteria in group B. This criterion was determined based on the MDO score in the questionnaire analysis, which was 2.73 ($2{,}51 \leq \text{MDO} \leq 3{,}25$). These results are supported by direct observations that only 65% of students are able to solve problems well. Confirmation was also carried out in a random interview process and the results were consistent with the questionnaire and observation score criteria. The students characteristics in group B were found that they already have the motivation to solve math problems, but sometimes the solutions used are still wrong. The students' constraints found in group B included students not being careful enough to understand the problem. However, the students in this case have been able to relate their understanding to the previous one.

Finally, group C has a poor level of mathematical position. The results of the questionnaire analysis obtained an MDO score = 1.80. This result belongs to the less good category ($1{,}76 \leq \text{MDO} \leq 2{,}50$). This result is supported by the observations and interviews results which show that only 30% of students' mathematical disposition activities appear, in addition 70% are not found either from self-confidence, flexibility in problem solving, persistent, full of curiosity, reflecting, and appreciating math application. The statement items from the students' mathematical disposition indicators that appear are: answering questions according to ability, daring to answer the questions, and asking the teacher or friends. However, the student's ability in this case shows a mathematical disposition that needs further treatment because it is considered to lack the motivation to solve and understand the problem well.

According to Mohyuddin (Mohyuddin & Khalil, 2016) that the inability of students to complete tasks is a common thing and is included in learning difficulties problem. Students who have learning difficulties have unique characteristics and different learning styles (Sarı & Yüce, 2020). Teachers must be able to monitor their progress and implement various teaching strategies in the classroom. There are many factors that influence elementary students' learning difficulties in mathematics (Yulita & Ain, 2021). These factors are: learning media used is less innovative, family environmental factors, lots of playing activities so that student learning activities become neglected, as well as excessive use of gadgets and TV.

In the future, these findings can be used as a reference for student problem profiles in improving students' dispositional abilities in solving mathematical problems. Teachers can take advantage of various media and appropriate learning models to make students interested in mathematics.

DISCUSSION

Evidence from the analysis of mathematical dispositions in elementary school students reveals that it is necessary to boost students' confidence in their mathematical work. Thus, students will be more adaptable in using various models to answer questions based on their level of

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comprehension. (Ramadhani, M., Sukamto, 2020)

This is in line with Marisa (2011) research evidence showing that mathematical disposition is significantly associated with problem-solving skills. In a similar statement, Rezita & Rahmat (2022) demonstrated the importance of understanding concepts based on students' experiences and the perceived usefulness of mathematics in enhancing problem-solving abilities. However, the most important factor is students' dedication and persistence in practicing and comprehending each problem, so that they can identify each step of problem-solving and provide flexible solutions based on their own apprehension.

Another finding relates to the significance of mathematics in the lives of students, thereby making it easier for them to make reference to the story problems in their own daily lives. This result is in accordance with Wulandari et al., (2020) finding that students' everyday experiences that are related to mathematics learning may boost their self-confidence and problem-solving abilities. This ability will occur when students attempt to comprehend their understanding of the problem they are facing. When the students do not really understand the problem, they have a tendency to guess without using any mathematical thinking processes. Therefore, they are unable to determine what to assume and what information is required to solve those problems. Furthermore, students may find it difficult to understand the problem's keywords, which makes it hard for them to solve it and figure out what it means.

Since this study is limited to the analysis of mathematical dispositions toward students' problem-solving skills, a more in-depth investigation into the mathematical dispositions that are influenced by students' age and gender is feasible to explore.

CONCLUSIONS AND RECOMMENDATIONS

The mathematical disposition ability of elementary school students in solving problems has its own uniqueness. The student's ability profile is divided into three groups: A (observation average score 85%), B (60% observation average score 85%), and C (observation average score 60%). The groups are determined based on mathematical disposition indicators number that appear during observations. The analysis results obtained through questionnaires, observation, and confirmation with interviews showed that the students' mathematical disposition abilities in group A were categorized as excellent with 95% of disposition indicators appeared. Group B was categorized as quiet good with only 65% of the students' mathematical disposition criteria being seen. Finally, group C is categorized as less good because 30% of students' mathematical disposition skills appear. This difference in outcome criteria is influenced by factors such as learning media used is less innovative, family environmental factors, lots of playing activities so that student learning activities become neglected, as well as excessive use of gadgets and TV.

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