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Analysis of Students' Analytical Thinking Ability in Solving Number Content Numeration Problems

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ABSTRACT

This study aims to describe the analytical thinking skills of class VIII A students of MTs N 1 Sarolangun in the 2024/2025 academic year in the second semester. Analytical thinking skills include identification, understanding, analysis, and problem-solving in an orderly and logical manner. The method used is descriptive qualitative. The instruments used in this study were tests and interviews. Data collection techniques in the form of analytical thinking ability tests for 27 students and interviews for six students. Data analysis was carried out through data reduction, presentation, and conclusion. The study results showed that students with analytical thinking skills were still in three categories, namely low, medium, and high analytical thinking skills. However, slightly more are in the medium category that meets the *differentiating* and *organizing* indicators. Therefore, learning improvements are needed to improve analytical thinking skills.

Keywords: Analytical thinking ability; Numbers; Numeracy

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Introduction

Education is the most critical foundation in preparing competent professional staff to face global challenges. One of the main goals of education is to provide students with high-level thinking skills, such as critical, creative, logical, and analytical thinking (Maesari et al., 2019). This ability is a basic need in today's society, where many complex problems arise and require structured thinking from individuals. Within formal education, analytical thinking skills can be trained in various subjects, including mathematics.

Mathematics is a technical tool for calculating, measuring, and training higher-order thinking skills (Husnaidah et al., 2024). Through mathematics, they learn to solve problems, make data-based decisions, and understand abstract concepts. Mathematics is used to solve problems in various real-life situations(Sabasaje & Oco R, 2023). Learning mathematics requires students to actively build knowledge to understand mathematical concepts and solve mathematical problems correctly and thoroughly. However, in reality, problem-based mathematics learning rarely occurs in the classroom. This is because, apart from the abstract nature of mathematics, teachers also have difficulty connecting learning topics with real-world contexts relevant to students' thinking(Takaendengan et al., 2022).

One of the most critical components of mathematics is mathematical literacy, which is called numeracy. Numeracy can be defined as the ability to understand and use statistical and probabilistic information effectively in various everyday situations (Sobkow et al., 2025). Numeracy is the ability or skill to connect mathematical concepts to solve everyday problems(Arofa, 2022). Mathematical literacy (numeracy) assessment aims to measure an individual's ability to use mathematical concepts, procedures, facts, and tools in various situations that are relevant to individuals as Indonesian and global citizens (Hidayah et al., 2021). Thus, numeracy can be understood as the knowledge and skills required to apply mathematics in everyday life and various relevant contexts.

Knowledge of numeracy, especially numbers, is fundamental to helping students develop. Thinking is a mental activity that helps us solve problems, make decisions, or satisfy our curiosity(Baderan, 2018). Analytical thinking is one of the essential skills of the 21st century. It is a set of soft skills that helps students recognize, collect, and process data related to the problem that needs to be solved efficiently (Phoodee et al., 2024). Analytical thinking skills are necessary to make learning more meaningful (Yurt, 2022). Thinking analytically combines various information to analyze and solve problems (Yuwono et al., 2020). The ability to think analytically, which covers logical reasoning, problem-solving, and critical analysis, is essential to understanding and controlling draft mathematics(Nkepah, 2024).

Some indicators can measure or see analytical thinking skills, one of which is the opinion delivered by Anderson and Karthwohl (S. B. Sartika & Nuroh, 2017): *differentiating, organizing*, and *attributing*. Besides that, there are three indicators of analytical thinking skills, namely: (1) categorizing data into parts that relate to the draft known, (2) organizing parts in a way to become one unity intact, and (3) finding relationships between data and concluding (Fitriani et al 2021). Furthermore, differentiating refers to classifying or dividing knowledge based on its relevance. Organizing is determining each part and its role in forming a knowledge structure. Meanwhile, connecting is the ability to reveal the information obtained as conclusions to assess the perspective behind the knowledge(Annisa et al., 2016).

Analytical thinking skills are essential not only for the academic success of students but also for their daily success in life. Learning mathematics requires calculation and understanding basic concept operation numbers, analyzing patterns, and using numbers in real-world situations. This skill enables students to recognize relationships between numbers and apply them to complex situations, such as making predictions and decisions based on numerical data. In addition, understanding number operations is one of the essential elements of mathematics, and it is widely applied in everyday life. In learning in school, students are often faced with mathematical problems that require them to understand, analyze, and solve problems related to numbers. However, many students are not good at solving calculation problems requiring analytical ability (Upoyo, 2022).

The analytical thinking ability of Junior High School (SMP) students in Indonesia is still relatively low (Akmala et al., 2019; Purwita et al., 2021; S. B. Sartika & Nuroh, 2017). The low analytical thinking ability, especially in solving problems that require deep understanding and problem-solving skills (Mahyastuti et al., 2021). In the context of learning, low analytical thinking ability impacts student learning outcomes that are less than optimal (Novita et al., 2016). One crucial aspect of learning mathematics is numeracy and understanding the concept of numbers, which requires logical and analytical thinking to solve problems correctly. Although previous studies have identified low students' analytical thinking ability, there is still a gap in the specific mapping of how students solve numeracy and number content problems. There has not been much research that directly describes students' thinking patterns when facing numeracy problems and their challenges in analyzing issues related to numbers.

This study describes students' analytical thinking ability in solving numeracy and number content problems. By understanding students' thinking patterns, educators can develop more effective learning strategies to improve students' analytical skills in solving mathematics problems. Thus, this study attempts to bridge the gap between the problem of low analytical thinking skills among students and the need for more appropriate learning strategies to improve these skills.

Methods

This study is descriptive qualitative, a method that describes and interprets an object as it is (Zellatifanny & Mudjiyanto, 2018). It was implemented in MTs N 1 Sarolangun in the second semester of the academic year 2024/2025. The subjects were 27 students from class VIII A. The election subject was based on a recommendation from a teacher who teaches at the school. The data collection technique in this study used the instrument test numeracy content number, which experts have validated.

In this research, students were asked to answer essay questions such as the following:

A store discounts buyers based on the price of the goods purchased. The following table shows the cost of goods before discounts, discount percentages, and the number of goods Andi purchased. If Andi brings IDR 1,200,000.00. How much money does Andi have left after buying the discounted goods?

***Table* 1**. *Price of goods and discounts*

Types of goods	Price per Goods (Rp)	Discount (%)	Amount Purchased
	50,000	20	3
	200,000	15	2
	150,000	10	4

Then, the researcher interviewed six students representing students with low, medium, and high analytical thinking abilities. Subjects with low levels only meet the differentiating indicator, medium levels meet the differentiating and organizing indicators, and high levels meet the differentiating, organizing, and attributing indicators. The ability measured was analytical thinking ability. The indicators of analytical thinking ability were applied using Anderson Karthwohl Stages (S. B. Sartika & Nuroh, 2017). Namely, *differentiating* means categorizing data into parts relevant to the known draft; *organizing* means organizing the parts systematically into a whole; and *attributing* means finding relationships between data and then drawing conclusions. At the same time, analysis data is done through reduction data, presentation data, and then conclusion.

Results and Discussion

After the evaluation and analysis, obtained results like in the diagram below:

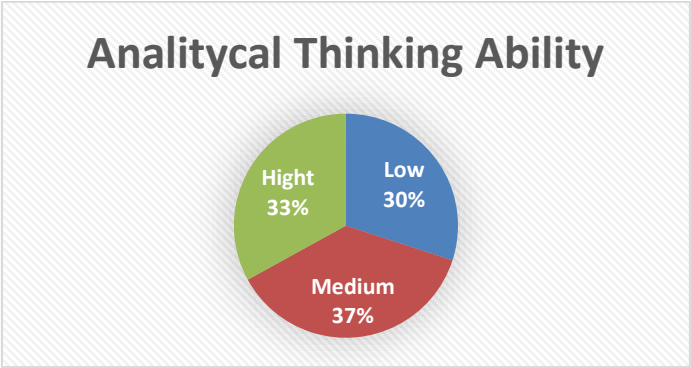

***Figure* 1**. *Percentage ability to think analytical*

The diagram shows that students' analytical thinking skills are still in three categories, namely low, medium and high analytical thinking skills. The researcher then conducted interviews to obtain more in-depth details on analytical thinking skills. The interview aims to collect additional information about students' analytical thinking skills based on previously developed indicators. The researcher interviewed

six selected students based on their level of performance and willingness and suggestions from the teacher about students who could cooperate in the interview to obtain more accurate information. The students selected were two with low levels, two with medium performance, and two with high levels. This was done to get a comprehensive picture of the differences in analytical thinking skills. Further elaboration of the analytical ability test results and interviews with the six respondents will describe more in-depth details.

Results analysis Students with ability low

After analyzing student performance, it was found that eight people were included in the category of having low analytical thinking skills, only fulfilling one indicator, namely *differentiating*.

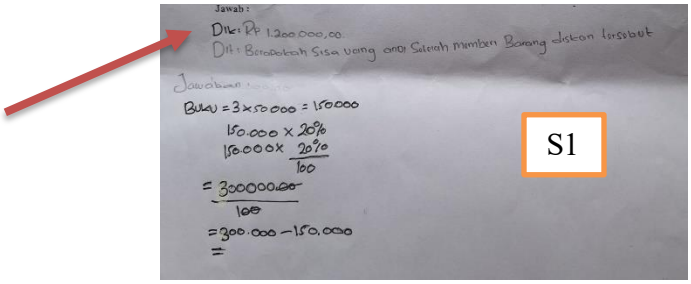

***Figure* 2**. *Results work S1*

Based on S1's answer, the subject only repeated the information known in the question, and the representation was not complete enough. S1 could not understand and recognize all the essential and relevant information. Understanding is the ability to grasp concepts, for example, represent, interpret, and categorize facts presented in different and understandable forms(Puspita, 2020). S1 then tried to proceed to the next step. Still, the steps did not follow the correct method, namely organizing the parts systematically into a whole unit, so the process stopped without producing the right solution. From this analysis, it can be concluded that S1 has not met the distinguishing indicator, namely the ability to categorize data in parts related to known drafts. This lack of ability indicates that S1 still has difficulty distinguishing essential and unimportant information and connecting data with the drafts needed to solve analytical problems. This may be one of the main factors causing S1 not to achieve the expected results.

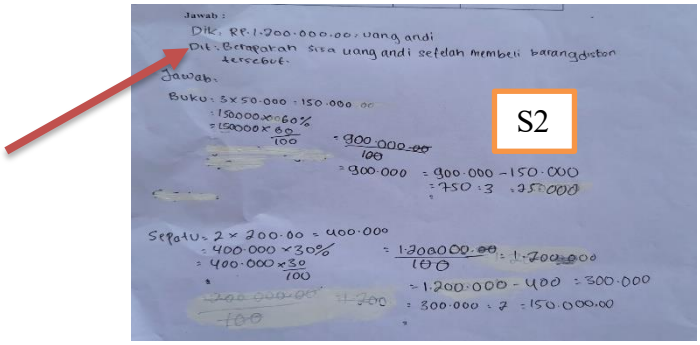

***Figure* 3**. *Results work S2*

Based on the results of S2's work, it can be seen that S2 has not fully fulfilled the differentiating indicator, namely the ability to categorize data into parts related to known concepts. S2 appeared to have difficulty extracting and relaying key information to the appropriate problem-solving draft. However, unlike S1, S2 showed further efforts to organize and regulate parts data systematically. This shows the effort to fulfill the organizing indicator, namely the ability to manage the parts systematically into a single unit intact. Unfortunately, even though S2 shows a more structured process, the steps are not quite right, and there is no appropriate leading solution. Effort S2 stopped, even though it has tried to process data systematically, understanding the underlying concepts needed to guide the solution steps more effectively and reach the expected results.

Based on the results of interviews with S1 and S2, it is known that students do not understand the questions and have difficulty solving them. As discussed in this study, the main factor is the lack of experience dealing with unusual questions. Even S1 stated that the 7th-grade teacher never gave complicated questions, so they were not used to thinking more complexly. Based on the results of interviews with undergraduate and postgraduate students, it is known that students do not fully understand the questions and appropriate concepts, so they have difficulty solving them. Many students experience problems due to a lack of understanding of relevant fundamental concepts and a lack of experience in dealing with unfamiliar or complex types of questions. One of the main factors that causes this is the learning approach that tends to focus on standard questions without encouraging students to face challenges that require analytical thinking. Then S1 emphasized that the 7th-grade teacher never gave complicated questions. In other words, these questions are new to them(Sulistiowati, 2022). As a result, students are not used to more complex thinking patterns. This gap indicates the need to improve learning methods so that students are better prepared to face questions that require them to use high-level thinking skills. This must be done because learning habits are not always directly formed in the student's personality(Giusti & Suriatie, 2021).

This research offers a new contribution by emphasizing the importance of early exposure to non-standard questions and the need for more effective teaching strategies to develop student's analytical thinking skills, especially at lower levels. These results indicate that low-level learners face significant obstacles in tasks that require analytical thinking skills.

Results analysis student with medium ability

The analysis results showed that 10 students had medium analytical thinking skills. Students at this level fulfill the three indicators of analytical thinking skills: *differentiating* (identifying and classifying related data), *organizing* (connecting data systematically), and *attributing* (assessing processed data and drawing conclusions based on evidence). However, they still make mistakes when applying certain concepts, leading to an inaccurate conclusion. For example, S3 can perfectly fulfill the differentiating function by separating the relevant data. However, a small error happens in the next step, which influences the accuracy of the conclusions (*attributing*). On the other hand, S4 also shows a differentiating achievement indicator, although the method is more straightforward than S3. However, the steps in S4 are not as complete as those in S3, which are systematically explained. This is evident in their answers, which show they are trying to analyze the information provided. The difference between S3 and S4 shows that skills think analysis students in this category are possibly different regarding completeness and accuracy of implementation concepts. This concludes that it is essential for teachers to deepen their understanding of conceptual students so that they may solve problems in a way that is more accurate and comprehensive.

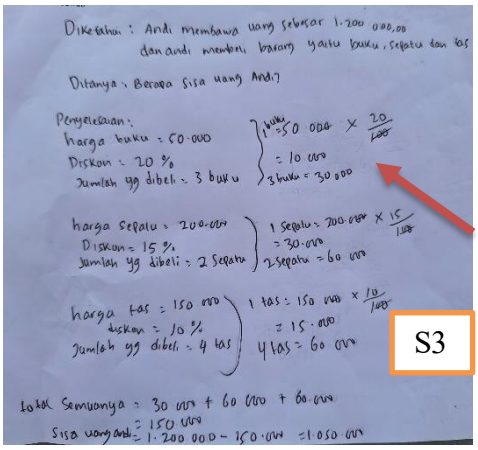

***Figure* 4**. *Results of S3 work*

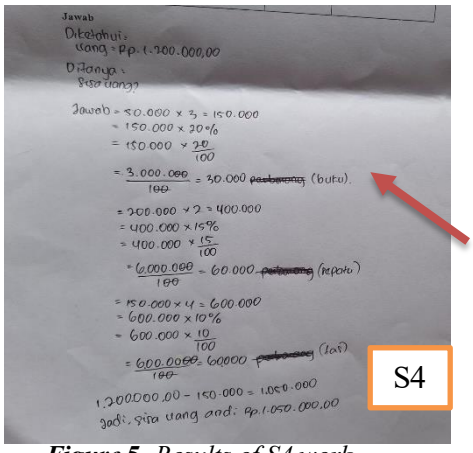

***Figure* 5**. *Results of S4 work*

Based on S3 and S4 responses, their biggest mistake was not understanding the concept of the price of a product after discounts. This indicates an error in applying the correct discount calculation procedure, which ultimately affects the results of solving the problem. To obtain more detailed information regarding their concept understanding abilities, researchers conducted interviews first with S3 and S4. Interviews

with S3 revealed that the subject admitted not paying enough attention to formulating his questions. S3 also stated that he forgot to mark the price of the item he wanted to buy, so he had to reduce the discount first. This shows that S3 understands some discount concepts but ignores the details, resulting in errors and damage issues. S4 stated something similar: he also mistakenly forgot to apply the price reduction procedure to items with a discount amount first. The researcher asked S4 why he did not write down all the information he knew. S4 said that other relevant information was already on the questionnaire, and therefore, he felt no need to write it down repeatedly due to time constraints.

These results reflect that habitual factors and strategy also influence results in addition to conceptual understanding errors. This shows that students need a deeper understanding of the concept and training to develop careful and systematic work habits. So, teachers must provide practice questions that require a deep understanding of concepts while emphasizing the importance of writing information that is known for ensuring settlement procedures are more structured and accurate.

Results analysis student with high ability.

Five participants can think analytically to get a mark of 10 from 10. At the same time, the other four students got marks 8 and 9 out of 10. Fifth, educate the third indicator on the ability to think analytically (*differentiating*, *organizing*, and *attributing*) well. Four other students were temporarily constrained in taking the conclusion. Analysis can be seen from Figure S5, which represents five students with excellent analytical thinking skills, and S6, which means students who are wrong in making conclusions or wrong count on the part end of problem-solving.

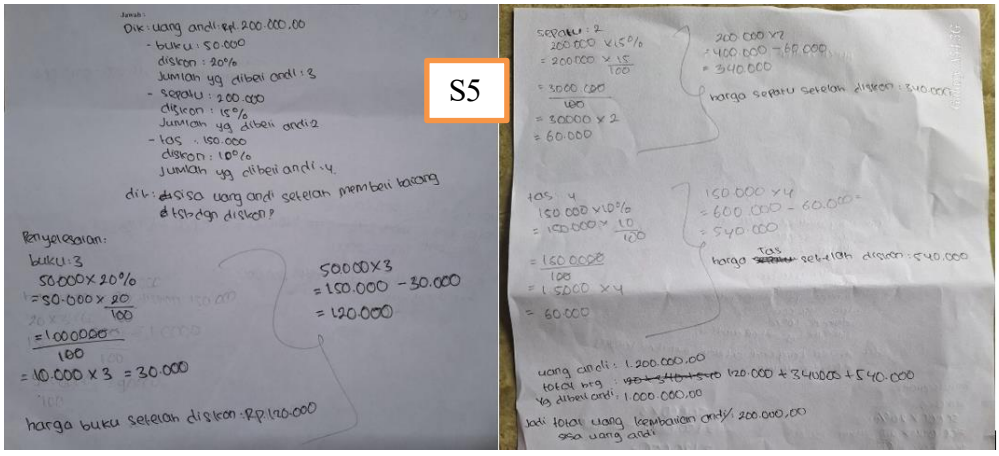

***Figure* 6**. *Results of S5 work*

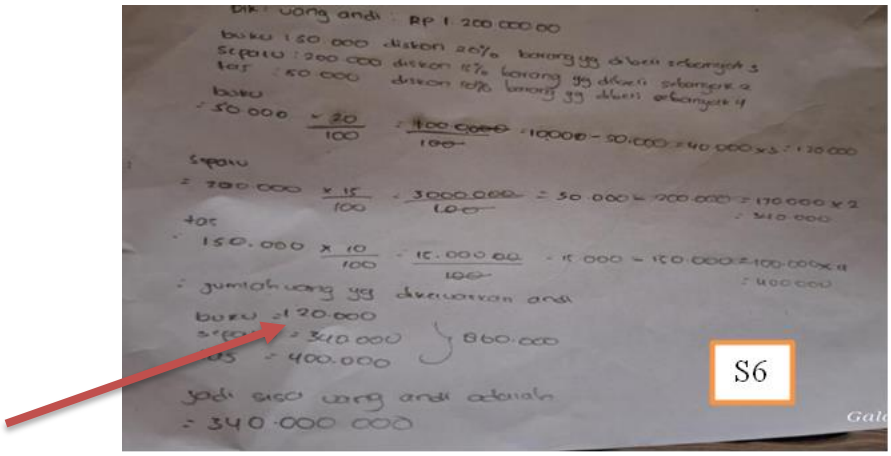

***Figure* 7**. *Results of S6 work*

Based on the interview results with S5, it was found that S5 often discusses non-routine questions in preparation for participating in a math competition. Meanwhile, in S6, it was found that S6 felt in a hurry. The time and moment count at the end of the settlement were, so there was an error when concluding. (Ayu et al., 2021) It also stated that students failed to complete mathematics test questions correctly due to inaccuracy.

The results of this research provide an essential contribution to understanding the role of analytical thinking skills in the learning process, especially in understanding and solving mathematical problems. Analytical thinking skills enable students to group data, build relationships between elements, recognize patterns, and draw conclusions in a logical and structured manner. These findings confirm that these skills help students solve complex mathematical problems and encourage a deeper understanding of the concepts studied.

In this research, several mistakes were found made by students. First, they have difficulty understanding the questions, so they cannot identify the already known information and what is being asked and have trouble writing down what should be done. Second, there is an error when using the formula; students cannot identify the correct formula or method to solve the problem given. Third, errors occur in solving operations, where students perform calculations incorrectly. Fourth, in conclusion, students pay less attention to the questions contained in the problem and cannot make appropriate conclusions from the results of the calculations that have been carried out. This is the same as research conducted by (Cahyani & Sutriyono, 2018) Which stated that students' mistakes in solving mathematics problems were conceptual errors, errors in operations, and carelessness.

In addition, this research highlights the critical role of teachers in developing analytical thinking skills through providing non-routine or contextual questions. This approach helps students get used to challenges that require high-level thinking so that they memorize concepts and apply them in various

situations. In line with the opinion (Sartika, 2019), this research's results strengthen the idea that mathematics teaching must focus on developing students' thinking abilities, not just delivering material. By actively involving students in the learning process, they can build knowledge independently and be more critical in dealing with various problems. This contribution provides the basis for developing more effective learning strategies to improve students' analytical abilities at multiple levels of education.

Conclusion

The study's results showed that most students in class VIII A MTsN 1 Sarolangun met two indicators of analytical thinking ability for numeracy content numbers: *differentiating* and *organizing*. Students included in the category of having medium analytical thinking ability. However, teachers must improve learning to improve students' analytical thinking abilities.

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