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ANALYSIS OF INTUITIVE AND ANALYTICAL THINKING PROCESSES IN MIDDLE SCHOOL STUDENTS IN SOLVING NATIONAL MATHEMATICS EXAM

Khusnul Safrina[1]

[1]*Fakultas Tarbiyah dan Keguruan UIN Ar-Raniry Banda Aceh*

Email: khusnul.safrina@ar-raniry.ac.id

ABSTRACT

The teacher's thought process in solving a math problem has rarely been concerned by the teacher. The thinking process of students in solving math problems includes intuitive and analytical thinking processes. The aim of this research is to explore the intuitive and analytical thinking process of junior high school students in solving the National Examination questions. The research method used is qualitative research that is exploratory in nature by selecting subjects who have high abilities in mathematics. Data collection in the form of descriptions of students' intuitive and analytical thinking processes was carried out through interviews. The results obtained in this study are a description of the process that students go through in mental when students solve math problems in the form of questions on the National Examination. The results of the study can be concluded that students in solving mathematics problems in the National Examination prioritize the process of intuitive thinking, where students can spontaneously and directly pour out ideas for solving the problems. In addition, in the further process, students also use analytical methods. Analytical thinking processes are carried out by students by detailing the answers based on the information in the questions.

Keywords*: think intuitively, think analytically*

INTRODUCTION

Nowadays, the teacher's thought process in solving a math problem has rarely been concerned by the teacher. Mathematics in schools serves to improve students' reasoning acuity in solving problems (Hamzah and Muhlisarini, 2014). The curriculum of 2013 also suggests that the objectives of learning mathematics are: (1) training ways of thinking and reasoning in drawing conclusions, (2) developing creative activities, (3) developing problem-solving skills, and (4) developing the ability to convey information. All of these goals are believed to be able to create better human resources than before. Improving human resources through education involves many parties who will be involved such as students themselves, teachers, government, and so on

The objectives of mathematics education are evaluated by the government through the National Examination (*Ujian Nasional* - UN). The National Examination (UN) is a means of evaluation that is carried out at the end of each level of education, both SD, SMP, and SMA. The National Examination must be followed by all students who have taken every level of education and implemented when the student has finished studying all the standard competency guidelines and basic competence that have been determined by the government. National exam results are the final results of student achievement at each level. The results of the evaluation of the national exam scores are ultimately the benchmark for the success of achieving the curriculum that has been compiled and developed by the government. This provision is based on Law No. 20 of 2003 concerning the National Education system, article 58 paragraph (2) which states that "The evaluation of students, educational units and educational programs is carried out by independent institutions periodically, thoroughly, transparently and systemically to assess the achievement of national education standards". In addition, the results of national examinations are also intended for government consideration in terms of mapping the quality of education, the basis for selection for the next level of education, determining student graduation in educational units, as well as coaching and providing assistance to educational units in an effort to improve the quality of education. (Government Regulation, 2006).

Every year the government announces the acquisition of UN scores in various regions through the official website of the Ministry of Education and Culture. And information was obtained that the UN examination scores for Mathematics at the junior and senior high school levels were the lowest scores among other subjects. The average national examination score for Junior High School Mathematics is 46.56 while for MTs it is 42.24. This indicates that the National Examination score for Junior High School Mathematics is still relatively low. Meanwhile, from the official website of the Ministry of Education and Culture, it was also informed that the average SMP Mathematics UN score in Aceh was only 38.8 and was ranked 33 out of 34 provinces in Indonesia. This means that the average scores for Mathematics in Aceh are below the national average.

Judging from the content of Mathematics material, namely the content of numbers, algebra, geometry and measurement, as well as statistics and opportunities, the low achievement of each content is also illustrated by the acquisition of each content, namely

39% of students answered correctly for number content, 51.24% for algebraic content, 42.27% for geometry and measurement content, and 55.60% for statistics and odds. This achievement is still classified as low and it needs improvement efforts in order to achieve better results.

The overall achievement of the Mathematics UN results has been illustrated in the data above. However, there were also students who were able to complete UN questions well, namely as many as 6.66% of students scored above 75. Even though the data shows that there are still low students who get good performance on the UN exams, information about the thought process can be reviewed. students in solving UN questions. This is done as input for teachers to find out the mental processes experienced by students in solving UN questions.

Implementation of the National Examination for mathematics is done by giving problems. In solving math problems, students go through a thought process to find solutions to the problems given. In this process, students must spontaneously solve mathematical problems that are presented in a variety of ways. For this reason, students should have the ability to think intuitively because they can come up with ideas and ideas in problem solving. This has been stated by Usodo (2011) that intuitive thinking has an important role in determining a mathematical problem solving strategy. This situation is illustrated by mathematics learning activities which have only been focused on training students to solve math problems through memorizing a lot of formulas. (Kusaeri, et al: 2018). This is not a significant problem for some students with high math abilities. However, this will be a big problem for some other students who have low math abilities. Whereas in fact, mathematics learning in schools is dominated by students with moderate and low abilities.

The thinking process of students in solving math problems includes intuitive and analytical thinking processes. Intuitive thinking processes occur when students spontaneously and immediately provide problem solving ideas. Fischbein (1987) explains that intuitiveness is a cognitive process that is spontaneous and immediate based on certain schemata. Meanwhile, the analytical process occurs when solving problems, a person must first specify the information used to understand a knowledge by using logical thinking, not based on feelings or guesses. As expressed by Amer (2005) that analytical

thinking is very useful in understanding parts of a situation, detailing facts and thinking on its strengths and weaknesses.

Nuclear and analytical thinking processes occur when students solve math problems. Usually students with high math abilities are able to come up with spontaneous ideas in solving problems. So it is necessary to study bc more deeply about the thinking process of students in solving problems. This is done to get a picture of what happens mentally in a person doing both intuitive and analytical thinking processes.

RESEARCH METHODS

Type of Research

This study uses a qualitative exploratory approach that aims to explore a phenomenon about what students experience as a whole by describing it in the form of words and language.

Time and Setting of Research

This research was conducted at one of *Madrasah (Junior High School)* in Banda Aceh, namely MTsN 1 Banda Aceh, which is located on Jalan Pocut Baren No. 114 Kelurahan Keuramat, Kuta Alam District, Banda Aceh. The data collection process of this research took place on April 6, 2020 and April 13, 2020 for the data triangulation process.

Subject of Research

The subjects in this study consisted of two students with high mathematical abilities. This subject was chosen in order for the researcher to study the thinking processes of students in solving math problems. Subjects were selected based on the results of recommendations by mathematics teachers at MTsN 1 Banda Aceh. This was done considering the state of learning in schools during the COVID-19 period was inactive, so that the selection of subjects was only based on interviews with Mathematics subject teachers.

Data Sources, Instruments , and Data Collecting Technique

The instruments in this study consisted of two types, namely the main instruments and the supporting instruments. The role of researchers as the main instrument is a tool for

collecting data and also directly interacting with subjects or students. In addition to the main instruments, in collecting data, supporting instruments are also needed, including: test question sheets and interview guidelines.

Data collection techniques used in this study were through giving test questions and interviews. The first stage carried out is by giving UN test questions to students then followed by conducting interviews with selected research subjects. The interview used was a semi-structured interview. Researchers can add questions from the interview guide when the researcher was conducting interviews in the field. This is conducted if the information provided by the research subject is considered incomplete.

Data Analysis Technique

At the data analysis stage, the researcher analyzed the data after the research process was completed and the data were collected using qualitative descriptive analysis. Data analysis was carried out interactively and took place continuously at each stage of the research until it was complete and until the data was saturated. The data obtained were analyzed using interactive analysis techniques including data reduction, data presentation and conclusion / verification (Miles & Huberman: 1992).

RESEARCH RESULTS AND DISCUSSION

Result

1. Description of the Analysis of Students' Intuitive Thinking Process Results

The research subject's intuitive thinking process in solving the national examination questions is described based on the data collected in the field. Data were collected through interviews and analysis by exploring the thought processes that students went through in solving national exam questions. Interviews to explore this information were conducted before the subjects answered questions. This aims to explore information about the initial idea or spontaneity of the subject in solving the questions provided.

The results of the analysis of students' intuitive thinking processes on number content were obtained by first giving the national exam questions to the research subject. The national exam questions on the content of the numbers given are as follows:

The ratio of Varrel, Saffa, and Mahesa money is 4: 3: 2. If the amount of money for Varel and Saffa is Rp. 42,000, then the sum of money for the three of them is ...

A. Rp 54,000.00

B. Rp 58,000.00

C. Rp 60,000.00

D. Rp 62,000.00

Furthermore, the research subjects conducted interviews to examine the intuitive th inking process that occurred at the beginning of the student planning to solve the problem.

Based on the result of interviews with subject 1, information was obtained that subject 1 students were spontaneously and immediately able to think about what strategies would be used in solving these questions. The intuitive character of catalytic inference and common sense appears after the subject reads the problem. In this case, the subject is not only fixated on certain formulas, but plans to finish with a more flexible procedure without being tied to the formula. Spontanistas subject 1 in planned the settlement of this matter because the students had never resolve problems similar to the previous.

Furthermore, the interview process was also carried out on subject 2 to explore the intuitive thinking process in solving problems. As with subject 1, interviews on subject 2 were also conducted before students answered the questions given. Based on the results of interviews obtained information that p roses intuitive that appears in the subject 2 is the nature of the *power of synthesis* and *common sense*. Subject 2 spontaneously explained the idea that came to mind to solve the given problem. The subject comes up with a solution idea by applying a certain algorithm. In this case the subject combines with the concept of algebra. This process occurs because the subject has also solved similar problems in previous experiences.

Furthermore, checking the validity of the two subjects' data by triangulating. Tangulation is done by giving the test at different times. The data collection procedure was the same as in previous studies. The questions given at this triangulation stage are as follows:

Comparison money two children is 2: 1 and j otal money both are Rp.45.000,00. If the ratio of money three children that are 5: 2: 1, then the amount of money they are three of them are ...

A. Rp . 15,000.00.

B. Rp . 30,000.00.

C. Rp. 60.000 , 00 .

D. Rp . 120,000 , 00 .

From the results of interviews with subject 1, information was obtained that the subject consistently solved problems using *catalytic inference* and *common sense* characters. Subjects can spontaneously and immediately express solution ideas using shortcuts. In addition, the subject also uses the experience he has in the process of solving similar problems. On the subject 2 also showed consistency intuitive thinking process path. The subject shows the *power of synthesis* and *common sense* characters appearing when the subject will answer the questions given.

Thus it can be described that subjects with high mathematical abilities can solve junior high school math problems on number content spontaneously and immediately. *Common sense* characters appear in both subjects. One of the subjects appeared the character of *catalytic inference* where students spontaneously and immediately came up with a solution idea using shortcuts and blending it with previous experiences.

2. Description of the Analysis of Students' Analytical Thinking Process Results

Data regarding students' analytical thinking processes in solving mathematical problems on number content were collected together with intuitive thinking process data.

From the results of the interview, it is illustrated that subject 1 subject can distinguish (*differentiating*) pieces of information that are important and relevant to solving problems. Subjects can find and relate the information used to solve problems. The subject also carries out *organizing* activities by linking existing information into an overall structure in solving problems. Furthermore, the subject can determine what material is contained in the given problem (*attributing*). This can be seen also from the results of the answers given by subject 1, which are as follows:

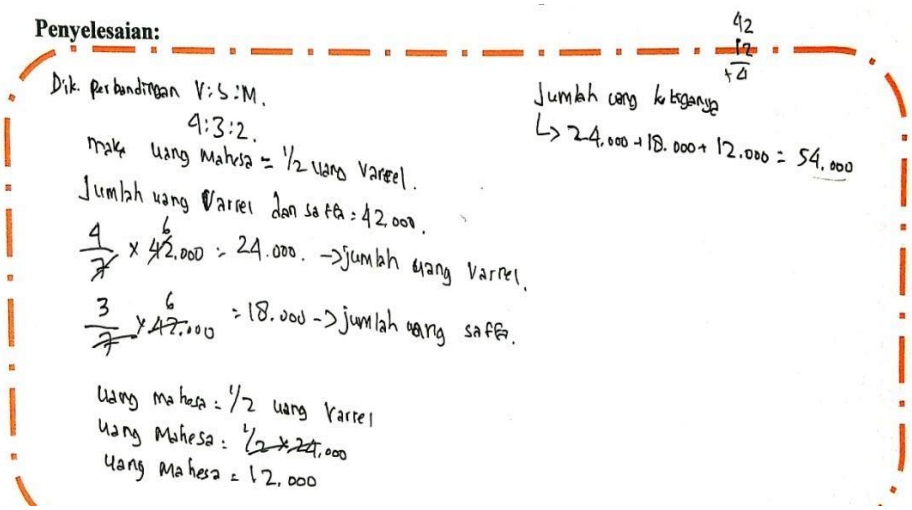

Figure 1. Answers to Subject 1 on Number Content

From the answers given subject image 1 shows that the subject of resolving the given problem with the analytic process, which includes the activities carried *differentiating*, *organizing*, and *attributin*g.

Furthermore, the process of analytic thinking in solving problems with the content of numbers is also studied for information on subject 2. The results of the interview showed that subject 2 thought processes in solving the given questions included *differentiating*, *organizing*, and *attributing activities*. Similar to subject 1, subject 2 also carries out analytical activities when solving problems on the content of this number. The answers given by subject 2 are as follows:

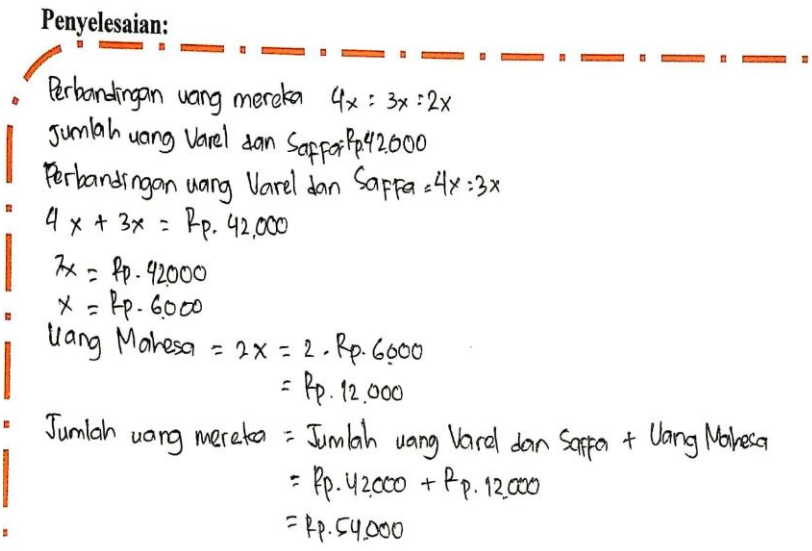

Figure 2. Answers to Subject 2 on Number Content

From the answers, it can be seen that subject 2 carries out activities to sort information and connect existing information to become a unit in solving problems. This process is an analytical process that is clearly illustrated by the answers given by the subject.

Furthermore, checking the validity of the data on the two research subjects through the triangulation process. The two subjects were also interviewed to see the consistency of the data obtained.

Based on the results of the interviews that have been presented, it can be seen that the data collected at this stage is similar to the previous stage. The subject performs an analytical thinking process which includes *differenting* , *organizing* , and *attributing activities* . The answer to solving the problem given by subject 1 also does not look much different from previous research. The results of the answers given by subject 1 at this triangulation stage are as follows:

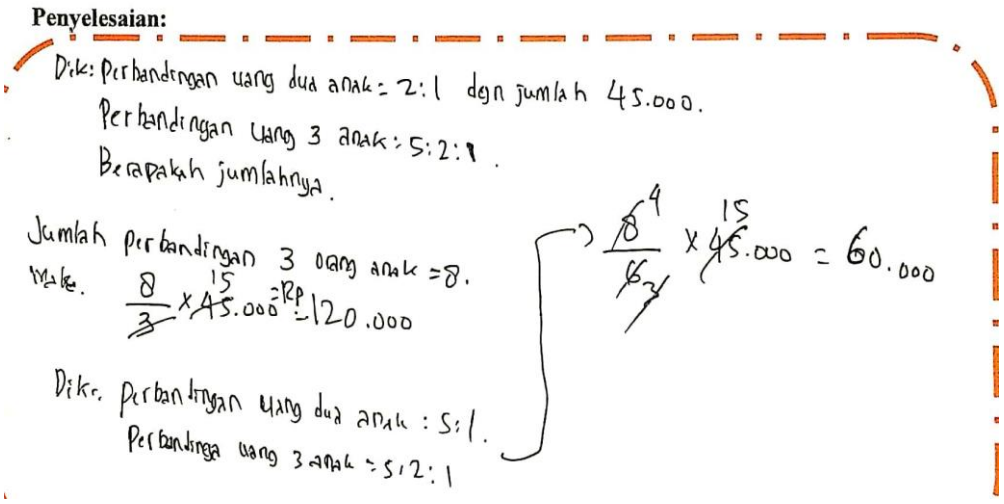

Figure 3. Answers to Subject 1 on Number Content (Triangulation)

Based on the answers given by subject 1, it is clear that the activities carried out include analytical activities where the subject differentiates and organizes important and relevant information into a single structure in solving problems. Subjects can apply the concepts to certain material for problem solving because the subject has been able to identify the material contained in the problem presented.

The results of the interview on subject 2 show the consistency of the data provided in previous studies. Where subject 2 uses analytical thinking processes in solving the given number content problem. The answer to the completion result on the number content given by subject 2 is as follows:

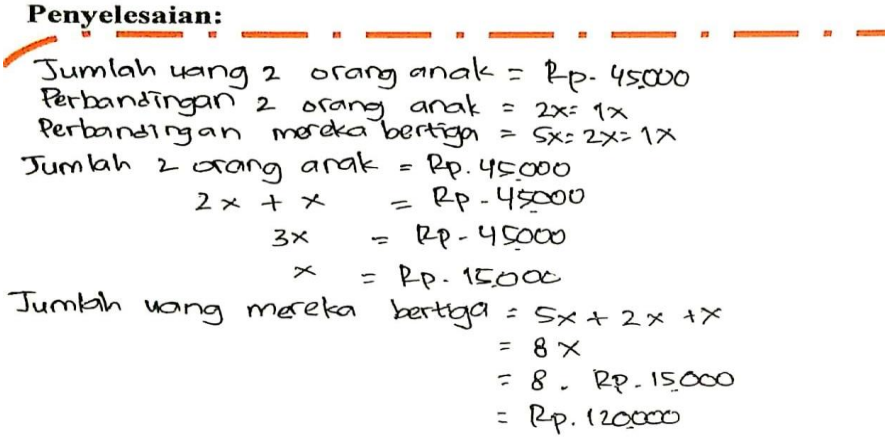

Figure 4. Answers to Subject 2 on Number Content (Triangulation)

The answer given by subject 2 is also not much different from the process carried out in previous studies. This means that the triangulation process does not need to be done anymore, because the data provided is consistent.

Thus it can be concluded that in the process of analytic thinking, both subject 1 and subject 2 do the same activities mentally. Where the subject carries out analytic activities in solving problems on the content of this number. Activities taking place include differentiating activity (*differentiating*) where the subject is able to distinguish a person associated with the process of understanding in finding and linking information used for problem resolution. The subject is also conducting organizing (*organizing*) also focuses on the suitability of the various elements of information and being able to function together in a structure. In addition, the two subjects have also been able to determine the point of view of the given problem, namely by being able to underline what material is contained in the given problem.

DISCUSSION

The results showed that the research subjects used both types of thinking processes, namely intuitive and analytical thinking processes in solving the National Examination

(UN) problems on each mathematics content at the junior high school level. This process occurs in a person's mental state which is characterized by activities that are implemented during the student problem-solving process.

Intuitive thinking processes occur in the subject starting when the subject will solve the given problem. At this stage the subject is able to spontaneously express the ideas and problem solving strategies given. As stated by Bunge (Muniri, 2018) that intuition is the ability to understand deeply and make feelings happen spontaneously (*spontaneity*). The subject expresses the idea of a solution based on previous experiences. Fischbein (1987) explains that intuitive thinking has a function as *cognitive mediating* which is a bridge of one's understanding in linking the object being thought of with the alternative solutions being used. In other words, someone will use intuition in determining strategies for solving a problem in mathematics. This has also been expressed by Dreyfus & Eisenberg (in Sa'o, 2016) that intuitive understanding is very necessary as a bridge of thought in combining initial conditions with the goals to be achieved.

The characteristic of intuitive thinking that dominantly appears in both subjects in solving problems on the content of numbers, algebra, statistics, and geometry is the spontaneity of the subject in providing solution ideas based on the experiences that both subjects have had with the given problem (*common sense*). This has been stated by Komandoko and Suherman (2017) who state that the process that underlies problem solving intuition is matching patterns that are sharpened through repeated training and practice. In addition, the two subjects also dominantly have a *power of synthesis* character where the subject is able to directly apply the algorithm. Dane & Part (2007) explained that one of the roles of the intuitive is as an input for making decisions.

In the content of numbers, a *catalytic inference* character appears in answering one of the research subjects. Subject using shortcuts. This is because the concept of numbers is more related to applications in real life, so that subjects can use shortcuts to solve the problems given in this content.

In addition to the intuitive thinking process, solving the problems given also includes analytical thinking processes. Where the subject resolves the problem given by certain procedures. This procedure also goes through several activities in a person's mental state. The process analytic thinking is a mental activity which includes differentiating, organize, and connect. In this study, the subject went through all of these

analytical processes. This can be seen from the description of the answers and from the results of the interviews conducted.

Based on the results of the research conducted, it can be seen that there is a combination of the two thought processes, namely intuitive and analytical. It can be seen that the subject uses their intuition to find solution ideas, then continues with analytic processes to solve the problems given to each mathematics content in junior high school. This is in accordance with Poincare's opinion (in Muniri, 2018) which states that understanding and solving mathematical problems requires intuition as a complement to analytic thinking.

Thus it can be concluded that someone in solving mathematical problems not only requires an analytical strategy, but also requires initial intuition to come up with the idea of a solution. So it can be said that intuitive and analytical skills are needed in solving mathematical problems.

CONCLUSION

The results of the study can be concluded that students in solving mathematics problems in the National Examination prioritize the intuitive thinking process, where students can spontaneously and directly express ideas for solving the problems given. In addition, in the further process, students also use analytical methods. Analytical thinking processes are carried out by students by detailing the answers based on the information in the questions.

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