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Research Article

Analysis of Santri's critical thinking with Problem Solving approach

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ABSTRACT

This study aims to describe the students' thinking ability in solving mathematical problems with Islamic nuances on the subject of the 7th grade set of MTs Darul Ulum Banyuanyar. Before conducting the research, the subject was given learning or knowledge about mathematics with Islamic nuances, more specifically the set material. The technique of taking research subjects is done by using purposive sampling technique. The selected subjects were 3 respondents. In checking the validity of the research using triangulation, the triangulation used is time triangulation. The results of this study indicate that high-ability students can pass all indicators in the indicators of critical thinking, creative and inductive reasoning. Meanwhile, for students with moderate abilities (second and third subjects) in critical thinking, the two subjects go through elementary clarification indicators, not through basic support indicators and determine strategies and tactic. Indicators for drawing conclusions (inference) and further clarification (advances clarification) can be passed, but in the work carried out, it is not done correctly. In creative thinking, students with moderate ability are both through the indicators of fluen-cy and flexibility, and not through indicators of originality and elaboration. Whereas in inductive reasoning the second subject only met two of the 3 indicators of inductive reasoning, namely, fulfilling the indicators of identifying mathematical processes/concepts and their tendencies from the given situation, and compiling estimates relevant to the statement. Meanwhile, in inductive reasoning, the third subject only fulfills one indicator, namely identifying mathematical processes/concepts and their tendencies from the given situation

Keywords: thinking analysis; mathematical critical thinking; problem solving approach; santri

1. INTRODUCTION

One of the oldest educational institutions in Indonesia and has been recognized for its existence for hundreds of years is the Islamic boarding school (Mastuti et al, 2016). Islamic boarding schools as one of the Islamic educational institutions in Indonesia have a very important role in the development of the world of education in Indonesia (Jannah, 2019). In Pesantren Education, "santri" is a measure of the success or failure of the pesantren's efforts in achieving the vision, mission and goals of education held (Hasanah dan Saleh, 2018).

Islamic boarding schools as one of the Islamic educational institutions in Indonesia have a very important role in the development of the world of education in Indonesia. In Pe-santren Education, "santri" is a measure of the success or failure of the pesantren's efforts in achieving the vision, mis-sion and goals of the education held (Griffin, 2014). This en-courages students to take part in boosting the success of In-donesia's development (Lee, 2017). Therefore, it is not enough for pesantren to only create students who have high knowledge but also must be able to create students who con-tribute to the country's industry (Hakim et al, 2018). Recently, Islamic boarding schools in Indonesia have developed their education system by establishing madrasas. In today's global era, general lessons are needed in improving Human Re-sources (HR), so that existing human resources can compete with other countries (Kaçan, 2015). In order to get quality human resources, general lessons must be supported by reli-gious lessons (Saleh et al, 2019).

Pesantren develop their education system by establishing Madrasah Diniyah. In the current global era, general lessons are needed in improving human resources (HR), so that the human resources produced can compete with other countries. In order to obtain qualified, qualified human resources and have a good personality and character, general lessons must be supported by religious lessons (Leikin, 2013). In public schools or schools under the auspices of the Ministry of Education and Culture, religious lessons have been given from elementary to secondary levels (Foster, 2015). But the hours of face-to-face are still few. Whereas in Madrasah Diniyah religious lessons are taught in depth, even religious subjects with general les-sons are the same (Herianto & Hamid, 2020).

Mathematics is a universal science, the science that un-derlies the development of modern technology (Fatah et al, 2016). Rapid development in the field of technology is based on the development of mathematics in various fields (İnce, 2018). Therefore, to master and create technology in the future, it is necessary to have a strong mastery of mathematics from an early age so that the human resources possessed are of high quality (Mursalin et al, 2018). Therefore, mathematics subjects need to be given from an early age starting from elementary to middle school to equip students with the ability to think logically, analytically, systematically, critically, and creatively (Arslan & Yavuz, 2012).

In this millennial era, students as students are required to be able to solve mathematical problems (problem solving) which are usually presented in the form of non-routine ques-tions. Non-routine questions are questions that require higher order thinking skills (Hargrove, 2013). These questions can only be solved by combining the previous students' knowledge related to more in-depth questions and thought processes. Because the subject to be studied is santri, the problem that will be used is a problem that contains Islamic elements (Hidayah et al, 2020).

Creativity is something that is rarely considered in learning mathematics. Teachers usually place logic as a talking point and consider creativity to be unimportant in learning math-ematics (Newton, 2013). In fact, if you pay attention to the 2013 Curriculum, it is stated that to face the challenges of the development of science and technology and information, it is necessary to have high-skilled resources that involve critical, creative, communicative thinking and the ability to work together effectively (Sriwongchai et al, 2015). This way of thinking must be developed through mathematics education. In addition, in the aspect of solving mathematical problems, creative thoughts are needed in making (formulating) interpreting and completing models or problem-solving plans (Sitorus, 2016). So, we need a method or method that encourages students' creative thinking skills in learning mathematics. By looking at the different learning processes between public schools and madrasas, it will certainly affect students' mindsets or students' critical thinking skills in solving problems, especially students who come from Islamic boarding schools. This can be reinforced by the opinion of Santrock (2010) which states that students from different backgrounds certainly have different knowledge bases, and such diversity will naturally affect their ability to complete assignments to involving higher order thinking (Jupri et al, 2014).

Santri are required to cultivate the ability to think logically, analytically, systematically, critically, and creatively. Santri are required to solve mathematical problems which are usually presented in the form of non-routine questions. Non-routine questions are questions that require higher order thinking skills (Akgul & Kahvecil, 2016). These questions can only be solved by combining the previous students' knowledge related to more in-depth questions and thought processes. Because the subject to be studied is santri, the problem that will be used is a problem that contains Islamic elements.

Creative thinking and problem solving can be trained by getting used to working on non-routine problems in many ways and creative abilities are considered important for students' future success (Gregory, Hardiman, Yarmolinskaya, Rinne, & Limb, 2013). Practicing creative thinking can be beneficial for students and help them cope with new situations and find new ways to solve problems, in other words creative thinking gives students life skills (Newton, 2013). For that reason, teachers should explicitly foster and teach creativity in mathematics learning (Švecová et al., 2014).

This study will examine the thinking ability of students, it will be examined how students' critical thinking skills in solving Islamic nuanced mathematical problems at MTs Darul Ulum Banyuanyar students. In this study, the researcher took the concept of the discussion of sets in problem solving where the set material is part of the algebraic topic (Saleh et al, 2019). In geometry, there are many symbols and notations (Sumberto, 2013). So that in understanding the meaning of symbols and notations, critical thinking skills and extensive knowledge of mathematics are needed. One of the characteristics of problem solving in geometry material is in the form of story questions that require knowledge and understanding of concepts to be able to identify and solve problems related to geometry, such as interpreting geometric shapes in the form of drawings, determining appropriate fields in spatial shapes, and problems related to the area and volume of the building space (Trisanti & Nusantara, 2021).

2. RESEARCH METHOD

This study uses qualitative research methods, namely the research method used to examine the condition of natural objects where the researcher is the key instrument, data source collection is carried out purposively and snowball with col-lection techniques using triangulation, data analysis is induc-tive/qualitative, and the research results are more emphasizes meaning rather than generalization (Sugiyono, 2010). In testing the validity of the test instrument, it is done by testing the validity of the construct (Arikunto, 2010). In testing the validity of the construct, it can be used with the opinion of the experts (Arifin, 2011). In a sense, the aspects to be meas-ured are based on certain theories in consultation with experts. Experts were asked for their opinions on the instruments that had been compiled. After being consulted by experts, the next step is to test the instrument which is useful for testing the validity of the items of the instrument. The following is the flow of the research stages.

The type of study used in this study is descriptive qualitative. So, the purposes of this study is to describe and produce a clear and detailed picture of the students' thinking skills in solving mathematical problems of set material in grade 7 MTs Darul Ulum Banyuanyar. The technique in taking research subjects was carried out using purposive sampling (destination sample). From the research subjects, 3 students were then taken as respondents or interview subjects. To obtain valid data, the researchers used two interviews with one test. The interview was conducted when the subject was working on the test questions and after doing the test questions (Dewi & Widyastuti, 2020). Further-more, the data that had been obtained was triangulated, and the results were analyzed to obtain conclusions. Data analysis techniques in this study were carried out by reducing data, presenting data, and drawing conclusions or verification.

In this study, various kinds of thinking skills that will be studied are about the ability to reason *(reasoning),* critical thinking, and creative thinking. The indicators used to see the students' thinking ability are as follows.

Indicators of mathematical reasoning ability according to Sumarmo (in Sumartin, 2015) in mathematics learning are as follows.

1. Draw logical conclusions;
2. Provide explanations with models, facts, traits, and relationships;
3. Estimating the answer and the solution process;
4. Using patterns and relationships to analyze mathematical situations;
5. Develop and study the conjecture;
6. Formulating opponents following the rules of inference, checking the validity of arguments;
7. Develop valid arguments;
8. Develop direct, indirect, and use mathematical induction.

From some of the indicators described above, the reasoning abilities studied in this research are: Inductive reasoning: Making estimates. This reasoning includes: (1) identifying mathematical processes/concepts and their tendencies from the given situation, (2) identifying the mathematical processes/concepts being asked, (3) compiling estimates relevant to the question (Sumarmo, 2016).

The indicators of mathematical critical thinking ability that were initiated by Ennis (in Lestari & Yudhanegara, 2015: 89), are:

1. Elementary clarification, namely, giving a simple explanation;
2. Basic support, namely, building basic skills;
3. Drawing conclusions (inference), namely, making conclusions;
4. Further clarification (advances clarification), namely, making further explanations;
5. Determine strategies and tactics (strategic and tactics) to solve problems.

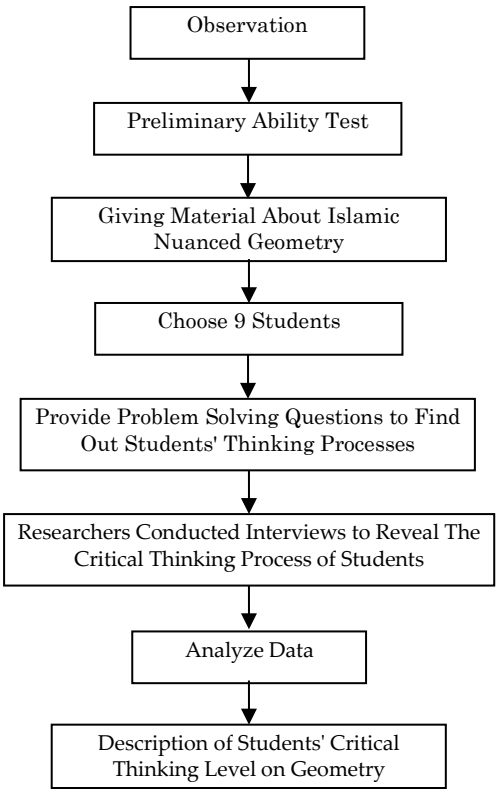

Figure 1. Research process flow

3. RESULTS AND DISCUSSION

3.1 Highly Skilled Subjects

Based on the results of data analysis regarding the students' thinking skills in solving Islamic nuanced mathematical problems on the set material, it was obtained information that the students in the upper group (SPT) on the first question about critical thinking, on the indicators of elementary clarification *(elementary clarification)* SPT perform activities (1) can mentions what information is in the problem at hand, (2) can identify what is being asked in the problem (**Figure 1**). In the basic support indicators *(basic support),* the SPT performs activities to find the reason it will be used in solving the given problem. In the indicator for drawing conclusions *(inference)* the SPT performs activities to plan the method used to solve

the problem. In the advanced clarification indicators, the SPT carries out activities to implement the planned method to solve the problem. And on the indicators of strategy and tactics (strategy and tactics) the SPT performs activities (1) can draw conclusions based on the right reasons, (2) reexamine the steps in problem solving given (**Figure 2**).

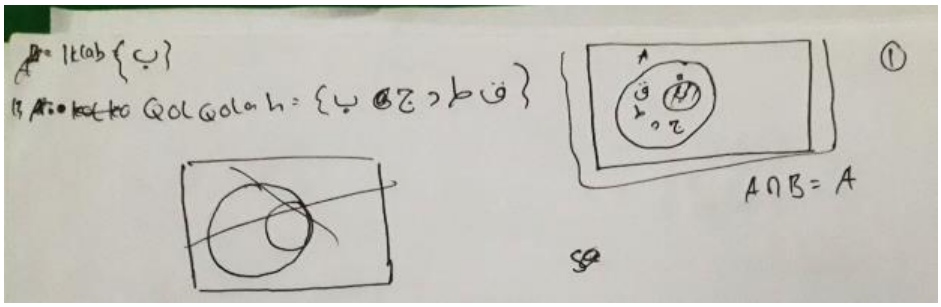

Figure 2. The Work of Subjects with High Mathematical Ability

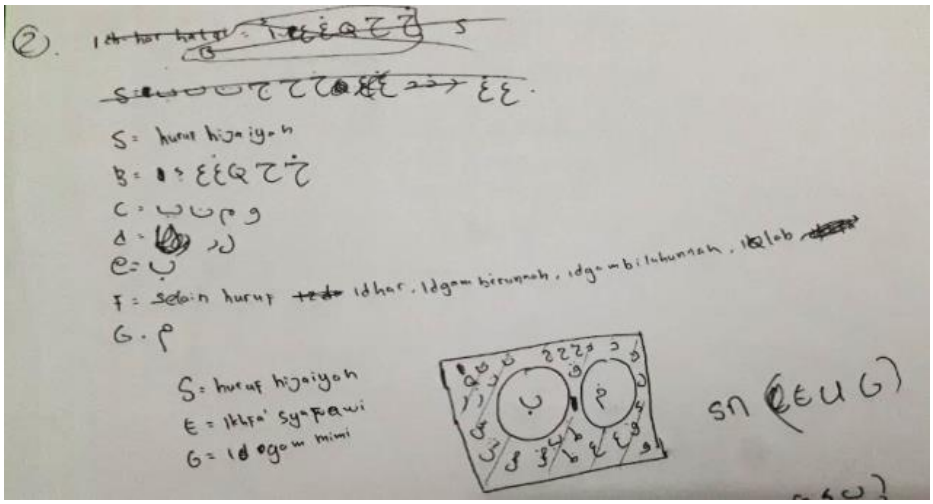

Figure 3. The Work of Subjects with High Mathematical Ability when explaining their work

This is in line with what has been said previously in the research conducted by Zayyadi (2015) which revealed that the high ability of mathematics students in understanding subject problems to identify and organize the facts that exist in the problem and formulate points that faced. In planning problem-solving problems, it is to find reasons that match the problems given correctly and plan formulas or rules to solve problems in detail, systemically, and appropriately (**Figure 2**).

In implementing problem solving, applying formulas to solve problems in detail and systematically as well as implementing plans and correctly as planned (Miatun & Nurafni, 2019). In addition, the subject provides conclusions based on reasons and grounds that have been carried out correctly so that they feel confident that the answers given are correct in re-checking the subject and re-examining the steps and final solutions in solving the problem and the reasons why it gives the final conclusion or results. This can also be strengthened by the results of research conducted by Subaidi (2016) on high-ability students who revealed that high-ability students mentioned the information known in the questions correctly and clearly, namely by rereading the appropriate information in the questions. Subjects also asked questions. in the question correctly. the subject mentions important and unimportant information in the problem, the subject explains the relationship of the information contained in the required problem, the subject explains the steps that will be used in solving the problem, the subject reveals the steps to solve the problem to be done by using reasoned judgment that is connecting the information in the problem with the subject's knowledge (Dores & Setiawan, 2019). With good enough knowledge making it easier to connect some accurate information (Cetin et al, 2021).

3.2 Medium Ability Subject

Based on the results of data analysis regarding the students' thinking ability in solving Islamic nuanced mathematical problems on the set material, it was obtained information that the students in the medium group (SKD) on the first question about critical thinking, on the elementary clarification indicators (elementary clarification) SKD doing activity (1) can mentions what information is in the problem at hand, (2) can identify what is being asked in the problem (Figure 3). In the basic support indicator, SKD cannot find the reason why it will be used in solving the given problem. In the inference indicator, the SKD performs activities that can plan the method used to solve the problem, but in the process, the SKD cannot do it correctly. In the advanced clarification indicator, the SKD can carry out activities that are planned to solve the problem, but it is not done correctly because of an error in the previous step. And on the indicators of strategy and tactics (strategy and tactics) SKD (1) cannot draw conclusions based on the right reasons, (2) does not re-examine the steps in problem solving given (**Figure 4**).

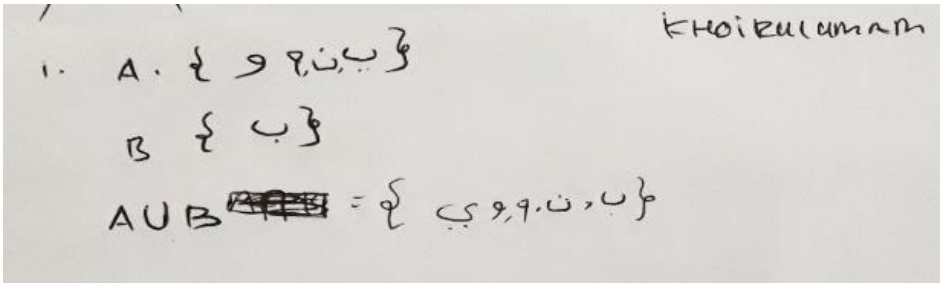

Figure 4. The Work of Subjects with Medium Mathematical Ability

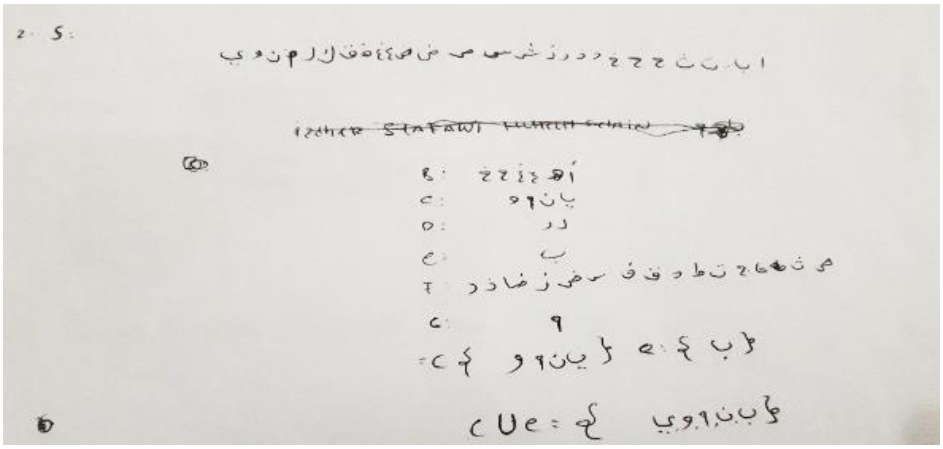

Figure 5. The Work Results of Subjects with Medium Mathematical Ability when explaining their work

When compared with the results of research conducted by Saleh (2019) on the ability of moderate mathematics students with the results of the data analysis carried out there are very striking differences in the indicators carried out by SKD. However, if the results of data analysis on SKD are compared with low abilities in Zayyadi's research (2015), there is an alignment in the indicators carried out by SKD and moderate ability in Zayyadi's research (2015). This can be seen from the results of research conducted by Zayyadi (2015) which shows that the low ability of mathematics students in understanding problems. Identifying subjects and only able to organize most of the facts that exist in existing problems and formulate problems contained in problem solving correctly. According to Saleh, et al (2019) In planning problem solving, the subject looks for the reason but it is not in accordance with the given problem. Regarding planning a formula to solve a problem but it is not appropriate and does not fit the given problem (Daud & Ayub, 2019). In solving problem solving the subject can solve but not in accordance with the given problem, resulting in the completion of the wrong result and not carrying out the plan according to the plan. Subjects make conclusions but are not sure of the final results obtained because the final results obtained are wrong, in re-checking the subject does not check the steps in solving the problem. This is in accordance with Mursalin's research (2018) which says that solving problems requires a high level of mathematical ability.

4. CONCLUSION

Based on the research findings and data analysis, it can be concluded that the students have high ability in critical thinking, all indicators are in the critical thinking indicators. In creative thinking, high-skilled students can also go through all the indicators that exist in the creative thinking indicators. Likewise, in reasoning or rather the ability of inductive rea-soning in making estimates, high-skilled students can go through all the indicators that exist in the inductive reasoning indicators in making estimates. For students with moderate abilities (second and third subjects) in critical thinking both through elementary clarifi-cation indicators (elementary clarification) SKD activities (1) can state what information is in the problem at hand, (2) can identify what is needed. asked in the matter. In the basic support indicator, SKD cannot find the reason why it will be used in solving the given problem. In the inference indicator, the SKD performs activities that can plan the method used to solve the problem, but in the process, the SKD cannot do it correctly. In the advanced clarification indicators (advances clarification) SKD performs activities that can apply the planned method to solve the problem, but it is not done cor-rectly because of an error in the previous step. conclusions based on the right reasons, (2) not re-examining the steps in solving the given problem. Based on the research findings, it can be concluded that the thinking ability of students needs to be improved again, so that the potentials that exist in students can be released and can be channeled to the maximum, with the hope that students can contribute more to development efforts in Indonesia. In addi-tion, for researchers who wish to conduct research like this, or continue it, it is hoped that the analyzed abilities will be more focused, such as focusing on only their critical thinking skills or their creative thinking skills or on their reasoning.

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AUTHOR'S CONTRIBUTIONS

The authors discussed the results and contributed to from the start to final manuscript.

CONFLICT OF INTEREST

There are no conflicts of interest declared by the authors.

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