Characteristics of intuitive thinking in solve mathematical issue based on cognitive style

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Abstract. This study aimed to describe the characteristics of intuitive thinking of junior high school students who have impulsive and reflexive cognitive style for solving 3D object problem based on Polya stages. This research was a qualitative descriptive study. The subject method is purposive technique. Data collection used problem-solving tests, interviews, documentation, and field notes. The result showed that: (1) Student with the impulsive cognitive style used intrinsic certainty for an understanding problem, extrapolative ness for planning problem solving, perseverance for solving a problem, and globality thinking for re-checking. (2) The student with the reflexive cognitive style used intuitive thinking of self-evidence for an understanding problem, extrapolative ness for planning problem solving, perseverance and implicitness for solving a problem, and not apply intuitive thinking for re-checking.

1. Introduction

Mathematical problem-solving activities are critical in mathematics learning. Efforts to get a solution or answer for the mathematical problem will differ from one student to another. A student will find it easy to solve a mathematical problem, but others have difficulty.

Muniri [1] said that problem-solving in mathematics is an activity to find solutions for mathematical problems by involving all knowledge (prior concepts) and provision of experience (trained and accustomed for dealing with or solving problems) that are not demanding specific ways or strategies in their solution. Based on these statements, mathematical problem solving can be divided
into two sections. Firstly, students use step by step that formal or analytical such as using formulas or rules of logic. Secondly, students use the solution directly, spontaneously, and irregularly.

Nowadays, most students do mathematical problem solving only limited to what have teacher given so that they have difficulty solving problems that teacher has never provided. However, there are some students who capable of solving problems correctly in their way by bridging the thoughts that arise spontaneously without using steps of completion in general. Activities like this are called intuitive thinking.

Fischbein [2], "Intuitions are defined in the present article as global, immediate cognition. Intuitions are always based on certain structural schemata ". Intuition is defined as direct or immediate cognition that is always based on certain structural schemes with no relying on at reasoning process and without justification or evidence and has several characteristics. Fischbein in Pratiwi [3] offers "the properties of intuition that are seen as immediate cognition." Characteristics include self-evident, intrinsic certainty, perseverance, coerciveness, theory status, extrapolativeness, globality, and implicitness. In doing mathematical problem solving either consciously or unconsciously, students often use intuition.

Several factors influence students' intuitive thinking in solving mathematical problems, one of them is cognitive style. It is based on conceptual differences in tempo related to time for the student to respond to a stimulus. Cognitive style in this classification is divided into two groups, impulsive cognitive style, and reflexive cognitive form. According to Rahman [4], people who have spontaneous cognitive techniques respond to a stimulus very quickly but experience many errors. On the other side, people who have reflexive cognitive form react to the stimulus slowly, more carefully, but accurately or mistakes made are relatively small.

To find out more about the characteristics of intuitive thinking students with both style, it is necessary to research students' cognitive and intuitive thinking characteristics used by the eighth-grade middle school in solving mathematical problems. The purpose of this study is to analyze and describe the attributes of intuitive thinking of junior high school students who have impulsive cognitive and reflexive cognitive style in solving mathematical problems based on Polya stages.

2. Literature review

2.1. Characteristics of Intuitive Thinking

Intuitive thinking comes from the word intuition. According to Fischbein [2], "Intuitions are defined in the present article as global, immediate cognition." Intuition is seen as cognition process directly or immediately whose truth can be received directly without justification. Hoggart in Pratiwi [3], "Intuition is seen as a thought obtained with little effort, and generally arises due to it is under one's consciousness."

Brunner in Sukmana [5], interpreted intuition as "an action to get meaning, significance, structure or situation from a problem without explicit dependence on analytic equipment possessed by an expert." Bruner concluded that even though there are people who have special talents (intuition), effectiveness would be achieved if someone has learning experience and understanding of the subject. Such statements are supported by the opinion of Burke & Miller in Sukmana [5], "intuition is not something that appears immediately, but is the result of long experience and involvement of emotional elements in it." Therefore, the ability of intuition can be formed based on experience.
Characteristics are particular traits or sign, so the attributes of intuitive thinking are special signs in intuitive thought. According to Fischbein in Pratiwi [3], intuition has common characteristics in mathematics, including self-evident, intrinsic certainty, perseverance, coerciveness, theory status, extrapolative ness, globality, and implicitness.

2.2. Mathematical Problem Solving

Nasriadi [6], "mathematical problem solving is a process, or student activities carried out to find solutions for existing problems." A problem might be a predicament for students is not necessarily a problem for other. Students who have excellent problem-solving skills will be able to solve the mathematical problems they face by using the concepts and knowledge they have, and vice versa.

According to Azhil [7], in mathematics learning, problem-solving does not only depend on the final answer but students’ thinking process in solving mathematical problems. It is similar to Polya's statement in Radiyatul [8] said that problem solving is "an attempt to find a way out of difficulty to achieve a goal that cannot be immediately achieved." Polya in Netriwati [9], there are four indicators or stages in problem-solving such as (a) Understanding the problem, (b) Planning a solution, (c) Resolving the issue according to plan, (d) Doing a check again.

2.3. Impulsive and Reflexive Cognitive Style

The difference of each in processing information and composing it from his experiences is called cognitive style. According to Grigorenko & Stemberg, "cognitive styles are aspects of overall personality and cognitive processes. It is a bridge between cognition or intelligence measures and personality measures "(Jena [10]. Each student has his or her cognitive style. Many experts have defined it, for example, Usodo [11] said, "cognitive style is an individual characteristic for using cognitive functions (thinking, remembering, solving problems, making decisions, organizing and processing information, and so on) which are consistent and persist."

Cognitive style based on conceptual tempo is impulsive cognitive and reflexive cognitive style. Purnomo [12], children who are casual cognitive style are children who have electric characteristics in answering problems, but not / less carefully, so answers tend to be wrong. Children with reflexive cognitive form are children who have the attributes of being slow in answering problems but are careful, so responses tend to be correct. Reflexive children usually take a long time to respond, but consider all available options; have high concentration when learning, while impulsive children lack mass in class.

According to Apriyanti [13] to determine the tendency of reflexive and impulsive cognitive styles used the Matching Familiar Figures Test (MFFT) or image matching tests. Kogan and Kagan in Fadiana [14], say that "MFFT is a typical instrument for assessing impulsive-reflexive cognitive style."

3. Research methods

This study used a qualitative descriptive research method, and design was phenomenological research. Ghony & Almanshur [15] said that phenomenology focuses more on the concept of a particular phenomenon and study model is to see and understand the meaning of an individual experience related to a specific event.
This research was conducted at 1st State Junior High School of Purworejo in the 2nd term of 2017/2018 school year and subjects were eighth-grade students. Subject selection was made by giving cognitive style tests namely MFFT (Matching Familiar Figure Test) owned by Jerome Kagan which was adopted and designed by Warli [16] that has been tested for validity and reliability by psychologists. After doing cognitive style test, researchers selected for the interview.

The sampling method used a purposive technique that chosen from the aspect of the representation of the research objective. As for criteria, (1) reflexive students were taken from reflexive student groups whose time is the longest and most accurate or accurate in answering (wrong frequency is small or less), (2) impulsive ones were taken from groups of impulsive students who have the fastest and inaccurate time records or accurate level is high when answering.

In this study, primary data source was researching subject, which is the 8th student at class A in 1st State Junior High School of Purworejo. Data collection techniques used in this study was tests, interviews, documentation, and field notes. An experiment was carried out to obtain learning outcomes to see the characteristics of intuitive thinking from research subject. The meeting was conducted with the aim to find out directly information on the research subject. Discussions in this study were held to explore the characteristics of students' intuitive thinking based on the problem-solving tests provided. The main instrument in this study was the researcher itself. Researchers did collecting data and analyzing directly through observations and interviews. Supporting devices used include cognitive style tests with MFFT and problem-solving test instruments.

Miles and Huberman said that activities in qualitative data analysis were applied interactively and continued simultaneously to completion, so that data was saturated Sugiyono [17]. The stages of data analysis are as follows:

a. Data reduction
   - Transmit the subject's explanation during the interview
   - Re-check the data transcript results by playing the recording

b. Presentation of Data
   - Presenting data from interviews
   - Discuss valid interview data to describe the data

c. Conclusions

4. Results and discussion

Selection of subjects was chosen from students of class A with a reflexive and impulsive cognitive style. To classify students based on their cognitive style, MFFT (Matching Familiar Figure Test) instrument is used. Test results were reflexive students totaling 10 students (32.26%), impulsive students totaling 10 students (32.26%), fast-accurate totaling 6 students (19.35%), and slow-inaccurate totaling 5 students (16.13%). These results indicate that the proportion of students who have greater reflexive or impulsive characteristics is 64.52%, compared to students who have characteristics that are fast and accurate in answering or slow and less accurate in answering, which is 35.48%. From these results, two subjects were chosen from each reflexive and impulsive cognitive style. The following are results of data analysis on inherent thinking characteristics of students who have automatic and reflexive cognitive styles.
4.1. Reflexive subject

At the stage of the understanding problem, the reflexive subject can understand it by reading questions first and understanding them both in first and second questions. At the time of the interview, the reflexive subject can understand the problem well directly without any justification so that it can be said that the reflexive theme in understanding problem uses the characteristics of Self-evidence intuitive thinking. This is by the theory by Fischbein in Pratiwi [3], that acceptance problems received directly without proof, and further checking can be said to be Self-evidence cognition. At the stage of planning completion, reflexive subjects can predict and estimate what will be done based on the experience they have before to plan for solving problems they are facing. According to Muniri [1], it is called the nature of Extrapolativeness, namely the ability to predict or foresee meaning behind empirical supporting facts so that it can be said that reflexive subjects in planning a solution use intuitive thinking characteristics Extrapolativeness. At the stage of solving the problem, reflexive subject tries hard to think of producing a solution. This can be known when the subject pauses as if thinking about something. The emergence of thought when working hard to solve a problem is encouraged because it will create conflicts or issues that Fischbein in Pratiwi [3] called Perseverance. Besides that, in the process of problem-solving, the subject can also make the truth of the statement hidden, which is said by Implicitness by Muniri [1]. This can be seen when the researcher tried to confirm an answer to the subject that is not clear, and then the subject can explain where he got the answer. Therefore, it can be said that the reflexive theme in solving the problem uses the inherent thinking characteristics of Perseverance and Implicitness. At the re-checking stage, reflexive subjects often do not check. Based on the answers generated by the reflexive subject, they made are only calculated and not done step by step. During the interview process, the question was able to explain the process in detail. According to Muniri [1], this is called the global nature, whole, holistic and sometimes contrary to cognition that is obtained logically, not always sequential and analytical thinking. Therefore, that it can be said that the reflexive subject in checking again uses the inherent thinking characteristics of Globality.

4.2. Impulsive subject

At the stage of problem understanding, spontaneous subject understands the problem by reading the question first and understanding it both for first and second questions. At the time of the interview, the involuntary subject can understand the problem even though by reading the issue several times. After that, when research confirms what the subject understands, the subject can be sure that what the subject reveals is a certainty and does not need external support. By the theory expressed by Fischbein in Pratiwi [3], natural means that the absence of external support is required to obtain a kind of direct certainty. Therefore, it can be said that the impulsive subject in understanding the problem uses intuitive thinking characteristics Intrinsic certainty. At the planning stage, the spontaneous subject can predict truth of a statement based on their previous experience to plan the solution for solving a problem they are facing so that it can be said that spontaneous subjects in preparing solutions use original thinking characteristics Extrapolativeness. At the stage of solving problem, according to the spontaneous subject plan can bring up a thought when the subject tries hard to solve the problem. So that it can be said that spontaneous, topics in solving problems use natural Perseverance thinking characteristics. At the stage of re-checking, impulsive subject have seen several times to check again.
From the subject's answer, it can be seen that the question made a step-by-step settlement so that the impulsive subject in testing again does not use intuitive thinking characteristics.

5. Conclusion

The result showed that: (1) Student with the impulsive cognitive style used intrinsic certainty for the understanding problem, extrapolative ness for planning problem solving, perseverance for solving a problem, and globality thinking for re-checking. (2) The student with the reflexive cognitive style used intuitive thinking of self-evidence for the understanding problem, extrapolative ness for planning problem solving, perseverance and implicitness for solving a problem, and not apply intuitive thinking for re-checking.

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