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Intuition and Its Role in Students' Mathematical Reasoning Ability

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Abstract

This study aims to find out more about intuition and its role in shaping students' mathematical reasoning abilities. In the discussion of the philosophy of mathematics intuition plays an important role. Intuition has been discussed by philosophers of mathematics for centuries. It is said that intuition is a provisional guess. In relation to mathematical reasoning ability, it is an indispensable ability for students because mathematical reasoning skills greatly contribute to the development of a set of 21st century skills. The method in this research is a library study approach. Researchers collect various references and sources, both international and national journals, books, and other articles related to the theme to be discussed. From the results of the discussion obtained intuition and mathematical reasoning ability are two things that complement each other in solving a mathematical problem. Intuition, which is a candidate for evidence, is then formally proven by mathematical reasoning with mathematical reasoning indicators. Intuitive processes direct the analytical process while quickly serving as a bridge in performing analytical reasoning. So if a person's intuition is good then his mathematical reasoning ability is also good. The potential of mathematical intuition in developing mathematical reasoning abilities is based on the theory that one component of intuition is reasoning

Keywords: *intuition, mathematical reasoning ability*

INTRODUCTION

Mathematics is a very important science in everyday life. In the school curriculum, mathematics subjects are always contained in the structure of the school curriculum at the elementary, junior high, high school and vocational school levels. Even in college, there are courses that include mathematics. In the current independent curriculum, mathematics subjects in Vocational Schools are included in the vocational

group, meaning that the subject group functions to form students as individuals so that they have competencies according to the needs of the world of work as well as science, technology, art and culture (Menpendikbudristek, 2022). In learning mathematics in schools, it should not only convey material related to subjects. Students must be equipped with mathematical abilities as their provisions in facing competition in the world of work and industry as well as in overcoming everyday problems. In vocational schools, mathematics is very important to improve students' competence in their professions in the future (Ozdemir & Onder-Ozdemir, 2021; Bakker, 2014).

Mathematical reasoning ability exceeds problem solving in the real world. In this case mathematical reasoning contributes to the development of a 21st century skill set (OECD, 2018). Reasoning is at the core of mathematics (Ross, 1998; Steen, 1999; Arnesen et al. 2019). Mathematical reasoning is a core ability in human intelligence (Saxton et al., 2019; O'Neill, 2019). Reasoning ability is the main predictor of academic achievement. This means that the greater the reasoning ability, the better the academic achievement. Therefore, it is very important to cultivate reasoning abilities among students, so that they can excel in all fields, both general and academic in particular (Bhat, 2016).

Intuition plays a role in learning mathematics (Sukmana, Agus, Wahyudin, 2011). In mathematical discoveries, intuition must be involved, intuition is an important part of mathematics, intuition is a reason that can be used as a guess, namely as a candidate for proof (Hers, 1997). Intuition involves a certain kind of reasoning (Baylor, 1997, p.). Minimum Competency Assessment (AKM) is a minimum ability assessment carried out to students. The minimum ability in question is the most basic ability that must be possessed by students at a certain level. These basic abilities in this case include reading literacy and numeracy. This ability is in accordance with 21st century skills that require students to be able to keep up with the times that are full of challenges. Minimum Competency Assessment requires students to use various cognitive skills in answering questions. Numerical cognitive level The Minimum Competency Assessment is divided into three levels, namely knowledge, application and reasoning (Center for Assessment and Learning, 2020). Based on the results of the Minimum Competency Assessment at SMK N 1 Demak in 2021, the results were below the average. Students have difficulty

working on AKM questions, especially on AKM questions at the highest level, namely the level of reasoning.

From the above review, intuition and mathematical reasoning skills are needed in learning mathematics. In this study, it will be discussed how the role of intuition in mathematical mathematical reasoning abilities will be discussed.

METHODS

The author uses a literature review approach (library review) in this study. The Literature Review seeks to describe, summarize, evaluate, clarify, and/or integrate related sources (Cooper, 1988). Literature review is an assessment of the overall contents of the literature related to certain questions (Fraenkel et al., 2012). The author collects various library materials, sources and references related to mathematical reasoning, and intuition in the philosophy of mathematics in this study. The author conducted a literature review to find out more about what intuition is, how intuition is in learning mathematics, and how intuition plays a role in students' mathematical abilities. Then various sources, references and literature can be used as theories in the discussion of research by redefining concepts and theories in the researcher's own language style.

RESULTS AND DISCUSSION

In Hers (1997) intuition is an essential part of mathematics. There are several meanings of intuition, namely intuition is defined as the opposite of rigor, intuition is interpreted as visual, intuition is interpreted as reasonable, intuition is interpreted as incomplete, intuition is interpreted as a physical model, and intuition is interpreted as holistic or integrative as opposed to detailed and analytical. Formalists believe that intuition is an unconscious formalization. Cauchy in Hers (1997) says that subconsciously knowing the proof of the theorem is correct, which means knowing the correct definition of all the terms in the theorem. This answer is of interest to many mathematicians who have made correct conjectures that they could not prove. If their intuitive guesses are the result of subconscious reasoning, then (a) Either the subconscious has a better secret method of reasoning than any known method; or (b) the proof is in my head, I can't get it out.

There are three components of intuition, which occur suddenly, relate to sensing a relationship and reasoning (Baylor, 1997). An intuition occurs suddenly without being planned. The connection-sensing component reflects the formulation of the connection,

an intrinsic property of intuition. The formulation of connections is based on the structure of one's knowledge. Intuition and reasoning are a unique relationship. The concept of intuition is different from analytical reasoning, but intuition involves a certain type of reasoning. The intuitive process directs the analytical process while, at a glance, describes the student's life. The success of the analytical method is manifested in evidence, while the success of intuition is manifested in seeing, creating images in the mind and understanding.

According to Dane and Pratt that intuition is used in making decisions quickly and effectively in making a decision (Dane & Pratt, 2007). Intuition processing occurs outside the conscious mind (Dane & Pratt, 2007). Bunge (1963) describes intuition as reasoning, namely catalic inference, power of synthetics and common sense. Catalic inference is a transition from one proposition to another very quickly by skipping the stages so quickly that the premises and processes are not noticed, so that only a trained mind arrives at the conclusion of power of synthetics, defined as the "ability" to combine elements that are mutually exclusive. heterogeneous, or dispersed into a coherent or harmonious whole." However, only a highly logical mentality is capable of achieving a synthetic perception of a logical relationship or set of relationships. Such a skill is defined as intellectual intuition. Common sense is a judgment based on knowledge, conclusions are quick, automatic, and easy.

Kant said that intuition is divided into two groups, namely pure intuition and empirical intuition. According to the classical intuitionist view, intuition is built from everyday informal knowledge, for example the intuition of preschoolers in performing simple arithmetic calculations such as counting and adding. On the other hand, in the inferential intuitionist view, intuition is constructed as a result of formal learning or training (Kant's, 1896). Intuition is constructed based on certain components. The intuition model is described in three components namely immediacy (immediate), relationship sensing, and reasoning in which these interactive components contribute certain aspects of intuition: components of proximity and relationship contribute insight; the relationship and reason components contribute to metaphorical and analogical thinking; and, proximity and reason components contribute to the type of action-oriented reasoning as opposed to metacognition (Baylor, 1997).

Reasoning is a concept that is central to mathematics along with the concept of proof and some mathematics educators emphasize that reasoning is necessary for learning school mathematics. Reasoning and proof are central aspects of mathematics as a discipline, and many researchers argue that reasoning and proof are a central part of school mathematics in all grades and across all topics (Arnesen et al., 2019). Individuals who have the ability to reason in a subject have knowledge of related disciplines and can analyze new situations encountered in all aspects, explore, make logical assumptions, explain their thoughts, reach conclusions and defend their conclusions (Umay, 2003).

The indicators of mathematical reasoning ability according to some experts are as follows. According to Elvis, indicators of mathematical reasoning ability are (1) draw logical conclusions (2) provide explanations about existing models, facts, properties, relationships or patterns, (3) make conjectures and evidence, (4) use relationship patterns to analyze situations or make analogies or to generalize (Elvis Napitupulu et al., 2016). According to Lithner, indicators of mathematical reasoning ability are as follows (1) Problem situation is met, (2) Strategy choice: choose, remember, construct, find, etc. (3) Strategy implementation (4) Conclusion: Results obtained.

Reasoning is necessary for important mathematical skills such as understanding mathematics, solving problems, and proving (Öztürk & Sarikaya, 2021). Reasoning is defined as the process of drawing conclusions. Moreover, these conclusions inform problem solving and decision-making efforts because humans are driven by goals and the conclusions they draw to help serve and fulfill their goals (Leighton, 2004)

The results of Ben-Zev's research (2021) say that based on philosophers, intuition can be learned. When students enter school, they are equipped with various mathematical abilities and their respective intuitions. Over time, students not only strengthen the construction of mathematical knowledge but also strengthen their intuition in building secondary intuition (Ben-zeev, 2021).

Based on the results of research by Istiqlal (2019), intuition provides assistance to students in solving mathematical problem solving faster. Intuitiveness is more meaningful if students are given a short time to solve the problem while the questions given are many (Istiqlal, 2019). Muniri's research results say that in understanding and solving problems, intuitive thinking is needed. Intuitive thinking acts as a means of opening ideas during the analytical process (Muniri, 2018).

The results of Sa'o's research say that if students experience impasse in solving problems, intuitive thinking occurs. There are three supporting factors for the emergence of intuitive thinking, namely feeling, intervention and intrinsic. Feeling is the process of spontaneous and sudden emergence of ideas. When students face problem solving problems, spontaneous answers will appear, this is called intuitive thinking, because answering does not require a long way and does not take long during the interview. The emergence of intuitive thinking in solving mathematical problems is done in finding solutions to get the right solution in solving problems. Thus, it is concluded that intuitive thinking is an alternative solution in overcoming low mathematics learning achievement (Sa'o, 2016).

Evan, in his research says that intuition dominates in controlling our thoughts, while reasoning rationalizes behavior. Philosophers have historically emphasized the importance of logical reasoning not on intuition, but recently there is evidence that intuition is very dominant in decision making in the real world. However, if we rely heavily on intuition, it is also dangerous, so reasoning is needed. Intuition largely reflects past learning experiences. Intuition works quickly, parallelly and effortlessly (Evans, 2010).

Intuition involves a certain type of reasoning (Baylor, 1997). If we look at the intuition aspect (Baylor, 1997) it will be found that intuition involves reasoning as one of its constituent components. Noddings and Shore claim that intuition acts in a complementary way with reason and it is impossible to separate the two (Baylor, 1997). Overall, intuitive processes can be described as modes of reasoning which ironically incorporate temporal analytical processes (Baylor, 1997). Through these statements, it can be seen that intuitive thinking and analytical thinking involve different thought processes but the existence of these two things supports each other. Intuition is needed in students' thinking processes, including proof. An indispensable partner for reasoning is mathematical intuition where intuition provides information about what is worth trying in order to prove (Hersh, 1997).

CONCLUSION

The analysis carried out on existing reference sources leads to a conclusion that reasoning is one part of intuition, so that both are interrelated with each other. The intuitive process directs the analytical process while quickly serving as a bridge in

performing analytical reasoning. So if a person's intuition is good then his mathematical reasoning ability is also good. The potential of mathematical intuition in developing mathematical reasoning abilities is based on the theory that one component of intuition is reasoning.

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