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Students' Intuition in Mathematical Problem-solving at the Stage of Understanding the Polya Problem

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***Abstract*—The type of this research is descriptive explorative with a qualitative approach, aims to know the intuition of students in solving math problems at the stage of understanding Polya problem. Data collection methods triangulate data through tests, interviews, and documentation. The subject of the research is a mathematics education student at the Muhammadiyah University of Cirebon. The population of the subjects was 50 students and then re-elected who had the initial ability mathematics with a score of 25 people, then selected 1 female student whose Academic Potential Test (APT) is medium and has good mathematical delivery. The results of this study indicate that the intuition of students in solving mathematical problems at the stage of understanding Polya problem: First, Subjection using intuition is self- evident intuition, that is, statement, representation, or interpretation is considered the subject by his / her self, the subject feels no need to show/ prove the truth of such statements, representations, or interpretations formally. Second, Subjects use certainty's intrinsic intuition, i.e., the subject assumes a statement, its representation, or its interpretation, a certainty, no external support (formal or empirical to obtain it). Third, the subject uses intuition perseverance, i.e., the interpretation and the resulting representation of the subject tend to be difficult to change. Prove it with the tendency not to use something new beyond its mathematical comprehension.**

Keywords—mathematics intuition, problem solving

I. INTRODUCTION

Mathematics is an exact science that is very relevant to the times/and it is the mother of all knowledge that forms the basis of other exact branches of science. Mathematics is a flow of science that continues to flow, and it can generate new theories in the world of mathematics and science education. One branch of mathematics that has become something new and much researched is about the existence of mathematical intuition that is a trend of current and future issues, where every mathematics learner must pay attention to the problem of mathematical intuition.

Intuition is formal cognition that refers to cognition controlled by mathematical logic and human mental activity in proving through mathematical induction or deduction [1]. Even it is said that intuition in mathematics is a bridge of human thought to deliver between the abstract concept of mathematics and the real world [2]. Thus, intuition can be useful to make it easier to understand abstract mathematical concepts to be more concrete based on the knowledge and experience they have and may be mixed with feelings or feelings. which previously existed in his memory about mathematics. According to research results indicate that intuition plays a role in decision making [3], understanding concepts [4] and problem- solving [2]. In the process of understanding concepts and solving mathematical problems, ongoing interactions between formal cognition, algorithmic cognition, and intuitive cognition. Furthermore, intuitive cognition performs the process of giving meaning, or informal interpretation of formal definitions, theorems, giving meaning or interpretation to a particular formula or procedure, or making assumptions or claims in a mathematical problem-solving. This clearly illustrates that a person's intuition is very closely related to the needs he wants in solving mathematical problems.

Fischbein [5] states that intuition has intrinsic certainty characteristics, namely intuition as giving / certainty, self-proof and immediacy, namely the subject sees their statements immediately accepted without the need for extrinsic justification by formal evidence or including empirical, persistence that is intuition resistant to alternative interpretations, coercivity that is, generally excluded as something that is unacceptable, globality is the global bidding intuition, which is different from the explicit, analytic and discursive, extrapolative ness that is extrapolating directly from the limited data information directly from the direct, implicit ie the intuitive process that is unconscious and people people who are only from the final product and the status of the theory that is intuition is theory, never like skill (skill) or perception.

This can be seen, after a number of claims or predictions are made, the person then rearranges it into a form of map or flow of mathematical problem solving according to the needs in solving mathematical problems. From this statement illustrates that mathematical intuition in its output will show different results, in accordance with one's experience and way of thinking, both in the way he responds or just the instinct they use to solve a mathematical problem-solving.

Problem- solving is the process of applying various skills and cognitive actions to a problem, which is intended to get the correct solution to the problem. And also said that problem solving is a set of actions taken to find a way out of a problem. This was expressed by Shumway [6] who defines problem-solving as "the set of actions taken to perform the task (i, e., Solve the problem)." Cognitive psychologists like Solso [7] define the problem- solving as directed thinking in

solving a particular problem that involves both the formation of responses and the choice between possible responses.

Judging from the problems described above, it is important to know how the students' mathematical problem-solving processes use their intuition when they try to solve mathematical problems with basic mathematical discussion through the problem-solving steps they do. Polya [4] developed a problem-solving procedure in four steps, namely: First, analyzing and understanding problem. Second, designing and planning a solution. Third exporting solutions to difficult problems, Fourth verifying a solution. Therefore, it is important to do a very interesting study with the title "student intuition in solving mathematical problems at the stage of understanding the Polya problem."

II. Research Method

This research uses an explorative qualitative approach, with the data collection stage starting from giving the initial ability test of mathematics to the subject, then testing mathematical problem-solving skills according to the stages, interviews with subjects with semi-structured techniques, data triangulation and time, and exposure the data is in accordance with the results in the field and do documentation. The subject of the research is a student of mathematics education at the Muhammadiyah University of Cirebon. The subject population amounted to 50 students and then re-elected who had an initial mathematical ability with a moderate score of 25 people/after that 1 student was chosen whose Academic Potential Test (APT) was being and had good mathematical delivery.

III. Result and Discussion

One question that can trigger students intuition can be drawn in this example; a hexos candy company has three sales stores in the city of Cirebon. Each shop provides 100 boxes of candy. One box consists of 15 large packs. One large pack contains 12 small packs. The price of one small pack of candy is Rp. 7,500, -. The hexos candy company, costs from each store for the following purposes:

a. 25% to pay employee salaries

b. 20% for capital and raw materials

c. 10% for store operating costs

Asked:

- If all hexos are sold out, how much is the sale of one store?
- What is the net profit of the hexos candy company from the 3 stores?

Subject Answer Results in accordance with the data exposure of students' mathematics education intuition in solving mathematical problems, female subjects at the stage of understanding the problem are:

1 city = 3 shops, 1 shop = 100 boxes of candy
1 box of candy = 15 large packs of candy
Price of 1 small package = Rp. 7,500
The price of 1 large pack (12 small bugs) Rp. 7,500, × 12 = Rp. 90,000
Price of 1 carton (15 large packs) = Rp. 90,000, × 15 = Rp. 1,350,000.
Sales of 1 store = Rp. 1,350,000, × 100 = Rp. 135,000,000.
So from 1 store is Rp. 135,000,000.

The question is if all the HEXOS candy is sold out, what is the sale of one store, and what is the net profit of the hexos candy company from the 3 stores. Here it is clear that the price of 1 pack of large candy with a capacity (12 small bugs) that is,

Rp. 7,500, × 12 = Rp. 90,000
Price of 1 box of candy with capacity (15 large packs)
Rp. 90,000, × 15 = Rp. 1,350,000.-
and sales proceeds for 1 shop Rp. 1,350,000, × 100 Rp = 135,000,000, -
So the result of 1 store is Rp. 135,000,000.
As for sales results from 3 stores are Rp. 135,000,000, - × 3 = Rp. 405,000,000.

Dialogue results of interviews between researchers and subjects

Researcher: Mba Azizah try to read the following questions well (giving basic math problems 1), After reading and understanding later say well, you love time, then write down what you know from this problem.

Subject: Yes sir, I read and understood first, later when it's finished, I say sir. Sir, I have finished reading and understanding this matter, what I understand from the question is about what was asked from the question, that is, if all Hexos candies are sold out, then what is the sale of that one store, then what is the net profit result (net) from the Hexos candy company from the 3 stores?

Researcher: Wait a minute, Azizah, do not rush to explain, what was known, and what was asked in this matter?

Subject: What is known is that there are companies that have 3 shops, from each store can provide 100 boxes of hexos, one box of candy consists of 15 large candy packs, 1 large packet containing 12 small packs and 1 packet sold at a price of Rp.7,500, The question is if all the hexos candies are sold out, what is the sale of that one shop, and what is the net profit of the hexos candy company from the 3 stores. Here it is clear that the price of 1 large candy pack with capacity (12 small bugs) is Rp.7,500, × 12 = Rp. 90,000, Price of 1 box of candy with a capacity (15 large packs) Rp. 90,000, × 15 = Rp. 1,350,000. and the proceeds of sale for 1 shop Rp. 1,350,000, × 100 Rp. 135,000,000. So the results of 1 shop are IDR 135,000,000. As for the proceeds of sales from 3 stores, Rp. 135,000,000 x 3 = Rp. 405,000,000.

Researcher: Azizah, have you worked on a problem like this? According to Azizah, the problem is easy to understand? Can you explain it?

Subject: No sir, according to Azizah the problem is quite easy to understand, sir, because the problem is that this is a matter of life that we often encounter every day, I understand that this question relates to how much profit from 1 shop and what net results from 3 candy shops The Hexos.

Researcher: Once I read the question, I immediately understood the point?

Subject: Yes sir, I immediately understood the point of this question, this question means to ask what is the sale of 1 shop if all Hexos candies are sold and also what are the profits of Hexos candy company from 3 stores, with expenses that have been determined which are 25% for salary employees, 20% for capital and raw materials and 10% for store operational costs. If you see the income from one of these stores is IDR 135,000,000, and also the income from 3 stores is IDR 405,000,000, then from here, I see the store has an expense of 25% for employee salaries, 20% for capital and raw materials and 10% for store operational costs. From here I write the expenses like this.

Researcher: Ana, when I read this question, I immediately knew what was known and what was being asked?

Subject: I immediately knew sir, what was known from this matter was the company with 3 shops, each of which provided 100 boxes of sweets, 1 box of sweets filled with 15 large packs, 1 large packet containing 12 small packs, 1 small package sold for Rp. 7,500, - and as for what is asked from this question is how much is the sale of 1 store if the candy runs out and the company's net profit is from 3 stores. That's all that is in my mind. When reading directly, I knew what I wanted about this.

Researcher: Somba Azizah once read the question immediately understood the point?

Subject: Yes sir, I immediately understood, I immediately understood the point of this matter, sir, because this question tells about life that many people in the company might experience, what this means is to tell you how many advantages of the hexos candy store and how much net profit of the 3 hexos candy stores, sir. That's what when I read the problem I immediately understood and understood the point of this matter.

Researcher: From the understanding of the problem, Azizah was sure?

Subject: I'm sure sir, I'm even very sure, sir, if you look at the problem, I am very sure what is known and asked, Insha Allah I have understood the purpose of this matter.

Researcher: Didn't Azizah think first, maybe what she understood was wrong?

Subject: Insha Allah is not mistaken, sir, I just worked on what was in my mind. Then I poured in an answer that I had submitted the answer to, sir

Researcher: Didn't Azizah think first, maybe what she understood was wrong?

Subject: Insha Allah is not mistaken, sir, I just worked on what was in my mind. Then I poured in an answer that I had submitted the answer to, sir.

Researcher: From the understanding of Azizah related to the answer, is there more?

Subject: What is it (While silently shifting the slide), it seems like there isn't any sir, that's all I have and the feelings I've believed in what's on my mind when I write on the answer paper according to what I think I am , that's all, sir, nothing else.

Researcher: How do you understand the problem?

Subject: First I read the problem carefully, I tried to understand what I wanted from this problem, then I don't know, how come I just crossed my mind about what I should write from understanding this problem, then I tried writing what already in my understanding related to what is known from the question, and what was asked from the question,...that's just how to understand the problem, sir.

The discussion of the results of this research interview shows that students' intuition in solving mathematical problems at the stage of understanding Polya's problem: First, Subjects using intuition that is self-evident intuition, that is, statements, representations, or interpretations are considered true by themselves, the subject feels unnecessary show / formally prove the truth of the statement, representation, or interpretation. as evidenced by the subject immediately understanding the purpose of this problem, the purpose of this problem is to tell us how much the profit from 1 HEXOS candy shop and also how much net profit from the 3 hexos candy stores. When the subject reads the problem immediately understand and understand the meaning. Second, Subjects use intrinsic certainty intuition, namely the subject considers the statement, representation, or interpretation, a determination (certainty), no need for external support (formal or empirical to obtain it). proven by describing that subject cognition is accepted as an individual feeling without requiring further checking and verification. And this is cognition whose truth statement is received directly. Third, the subject uses perseverance intuitions. Namely, the interpretation and representation produced by the subject tend to be difficult to change. It is proven by the tendency not to use something new outside of mathematical understanding. Proven by describing that the subject in understanding the problem he did not want to use alternatives other than what he believed to be the characteristics of his cognition which he understood about the problem, he refused other understandings to support his cognition.

IV. CONCLUSIONS

The conclusion of this study shows that students' intuition in solving mathematical problems at the stage of understanding mathematical problems according to Polya's steps are: Intuition used by the subject is self- evident intuition, that is, a statement, representation, or interpretation is considered a true subject by itself, the subject feels no need to show / formally prove the truth of the statement, representation, or interpretation. Then the subject at the stage of understanding the problem of mathematics uses also intrinsic certainty intuition, namely the subject considers the statement, representation, or interpretation, a determination (certainty), no need for external support (formal or empirical to obtain it). Then at the stage of understanding mathematical problems, shows that the subject also uses perseverance intuitions, namely the interpretation and representation produced by the subject tends to be difficult to change, not easily influenced by other

factors. This proves that the subject of student intuition in solving mathematical problems at the stage of understanding mathematical problems uses three intuition that can help understand the mathematical problems he is working on.

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