

Analysis of Mathematical Thinking Habits of Mathematics Education Students

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Abstract (12pt, bold)

Humans are individuals who experience changes in adaptation from students to students with different learning systems. Each adaptation experienced by students will differ from one individual to another. The purpose of this study is to find out the habits of mathematical thinking of students in mathematics education study program from one of the State University in Palembang. Respondents of this study were 50 students of the mathematics education study program at the state university. This study uses quantitative approaches. The design used is survey research. Survey was conducted by using closed questionnaire. The questionnaire consist of 32 statements regarding the habit of mathematical thinking in learning mathematics. The results of this study indicated that students are in the good category as much as 68.43%. For the indicators of flexible thinking and metacognitive thinking, each has a percentage score of 69.90% and 71.36%, all of which are in the good category. Meanwhile, thinking and communicating clearly and precisely has a percentage score of 63.6% in the sufficient category. It is hoped that further research will use the habit of mathematical thinking as a learning strategy to provide innovation in learning mathematics so that it has a positive effect on students to develop and improve the habits of mathematical thinking in learning mathematics.

Keywords : Habit of Thinking, Mathematical Thinking

Introduction

The development of human thought in providing boundaries regarding the meaning and meaning of education always shows changes at all times. The development of the mindset of educational experts, educational managers and educational observers has resulted in new theories.

Education is a conscious effort to create something inherited from one generation to another. Without going through an educational process, it is impossible for a person to develop in line with aspirations (ideals) for progress, prosperity and happiness. Through education, humans can broaden their horizons and obtain the knowledge they need. Education cannot be separated from learning in which there is a process of delivering material (knowledge) by teachers as a provision for students to solve problems in their lives.

Mathematics is a subject that is introduced from an early age in Indonesia, but students always think that mathematics is very difficult (Dwirahayu, Kustiawati & Bidari 2018). Maryono and Nur (2016) stated that mathematics is a discipline that focuses more on the thinking process than the results. This is possible because in mathematics learning activities, it is not only oriented towards mastering

mathematical material, but the material is used as a tool and means of achieving certain competencies (Dermaawan, 2019). Some even make math a measure of one's intelligence. These things cause education in Indonesia cannot be separated from learning mathematics. This can be seen from every level in education in Indonesia, there must be mathematics learning in it. In study programs that study computers, mathematical skills are the basics for mastering informatics. Therefore, efforts are needed to overcome their learning difficulties. Difficulties faced by students can be resolved with various habits that they always do. Mathematics is a language, an activity to solve a problem, an activity to discover and study number patterns. Therefore, mathematics is really needed by humans in solving various life problems.

One of the determining factors in mathematical ability is previous mathematics learning habits, or often called mathematical thinking habits. According to (Gordon, 2011), mathematical thinking habits support students to think, be reflective, and be creative in problem solving. Individual success is largely determined by the habits that individuals often carry out in their daily lives, including studying. Good study habits will have a good influence on individuals, and vice versa. Habits carried out by individuals are

usually referred to as mathematical thinking habits

One of the habits of thinking is the habit of thinking developed by (Costa and Kallick, 2008) which can be applied in all situations and used at all developmental age levels. (Costa and Kallick, 2008) shows that habits of mind contain various thinking habits that indicate the peak of personal intelligence, apart from that, thinking habits are also an indicator of academic ability which is related to success. Habits of thinking can also help individuals organize learning and find solutions to problems in interpersonal relationships and the work environment.

Mathematical thinking habits are affective aspects related to the way a person interprets problem solving such as; confidence, perseverance, accuracy, and flexibility in finding alternative strategies to solve problems in their mathematical field of mathematics by understanding, searching for strategies, and solving the problems they face (Hafni, 2019). According to Nugroho, et al (2019) habits of mind are habits used in applying mathematical steps integrated in problem-based learning to improve creative thinking skills.³⁸ Meanwhile, according to Indhira, et al. (2019) Habits of mind are a framework or guidelines for a person to think, act, and behave when responding to a

situation both in the context of learning and in the daily environment.³⁹ So it can be concluded that mathematical habits of mind are a person's treatment in responding to a mathematical problem and applying steps in solving it.

Gordon Marshall (2016) considers mathematical habits of mind as the heart of the mathematics curriculum to enrich student thinking. This will later lead students to do mathematics, create mathematics, and solve mathematical problems. Gordon's opinion is in line with the opinion of Dwirahayu et al, namely the success of problem solving is supported by habits of intellectual behavior patterns which are signaled by habits of mind.

In living their lives, humans are always faced with a variety of problems ranging from simple to very complex levels. In an effort to respond and find solutions to problems, especially complex problems, intelligent behavior and strong dispositions are needed. The habit of thinking equips individuals to work on real-life situations, equipping the individual's ability to respond with awareness, thinking, and strategies to get the right solution. Habits of mind equip individuals to work on real-life situations, equipping individuals' ability to respond with awareness, thinking, and strategies to get the right solution. Habits of mind can be used to assess their mathematical skills by

understanding, seeking strategies, and solving the problems they face (Evi, et al., 2020). Mathematical creative thinking ability can be interpreted as the ability to solve mathematical problems with more than one solution and students think fluently, flexibly, carry out elaboration, and have originality in their answers.

Methods

This research uses quantitative methods. Quantitative research according to Creswell (2012) is a method to test certain theories by examining the relationship between variables, usually measured using research instruments so that the data obtained consists of numbers that can be analyzed in accordance with the procedure. Quantitative research conducted in this study is related to obtaining data on the level of achievement of indicators of mathematical thinking habits of mathematics education students.

The design used is survey research. This research is to solve actual large-scale issue problems with a very large population, so a large sample size is needed (Widodo, 2008). The population in this study were mathematics education students at one of the state universities in the city of Palembang. Sampling was carried out by purposive sampling, where only mathematics education students in

mathematics study programs from state universities were selected. The research respondents were 50 students consisting of male students and female students.

In the research, the instrument used was a questionnaire to explore mathematical thinking habits which had 16 categories based on Costa and Kallick's categories of mathematical thinking habits. Where researchers only used 3 indicators of mathematical thinking habits of mathematics education students. The scores obtained are then interpreted in the interpretation table. Table 1 below contains a description of the indicators of mathematical thinking habits used.

Tabel 1. The indicators of mathematical thinking habits

No	Mathematical Thinking Habits	Indicator
1	Thinking Flexibly	-Used to have the capacity to change thoughts when receiving additional data. -Used to utilize various problem-solving strategies and imagining

		various consequences. -Has the habit of developing alternative answer choices with trust in intuition.
2	Metacognitive Thinking (Thinking about thinking)	-Consciously plan strategies to produce the required information. -Has the habit of maintaining strategic planning thoughts in the problem solving process. -Has the habit of evaluating yourself about what has been completed.
3	Thinking and Communicating with Clarity and Precision	-Used to solve mathematical problems with valid data. -Speak in writing appropriately when explaining mathematical descriptions.

These indicators are outlined in a statement in the questionnaire using a 1-4

Likert scale with a positive-negative score and the criteria used are in Table 2 below.

Tabel 2. Questionnaire score

Pilihan Jawaban	Skor Positif	Skor Negatif
Selalu (SL)	4	1
Sering (SR)	3	2
Kadang-kadang (KK)	2	3
Tidak Pernah (TP)	1	4

Results and Discussion

The percentage range of mathematical thinking habit scores for mathematics education students was obtained from data collection using a questionnaire instrument. To determine the level of mathematical thinking habits of mathematics education students regarding mathematical abilities, an analysis of the questionnaire that was given to students was carried out. The questionnaire contains 32 statements in accordance with indicators of mathematical thinking habits which consist of 3 indicators according to Costa and Kallick. The questionnaire results are given a percentage range in table 3 below.

Tabel 3. The percentage of mathematical thinking habits

No	Percentage Range	Cathegory
1	84,01-100	Excellent
2	68,01-84,00	Good
3	52,01-68,00	Fair
4	36,01-52,00	Poor
5	20,00-36,00	Bad

Below are presented the results of a questionnaire on students' mathematical thinking habits. For more clarity, see table 4 below.

Tabel 4. Score for each category of Mathematical thinking habits

No	Indicator	Percenta ge	Cathego ry
1	Thinking Flexibly	69,9%	Good
2	Metacognitiv e Thinking (Thinking about thinking)	71,36%	Good
3	Thinking and Communicati ng with Clarity and Precision	63,6%	Fair

From the table above it can be seen that students' mathematical thinking habits

regarding mathematical abilities are good and there are still sufficient categories so that there is still a need for mathematical learning that can provide positive habits that can improve students' mathematical abilities. For greater clarity, the following is a description of students' mathematical abilities based on their previous mathematical thinking habits.

Based on the categories of mathematical thinking habits, it can be seen that students' mathematical thinking habits fall into 2 good categories and 1 sufficient category. This means that most students are used to thinking flexibly and thinking metacognitively, while the indicator for thinking and communicating clearly and precisely is 63.6%, so it still needs to be improved. Most students have not prepared how to solve math problems in advance, but do it straight away. Meanwhile, the other indicators are in the good category, this means that students already have the habit of thinking mathematically. Then the overall percentage of the 3 indicators is in the good category with 68.43%. This shows that mathematics education students are good at mathematical thinking habits.

Individual development, especially students, should have developed well and have developed positive mathematical thinking habits so that students' mathematical abilities can develop well,

however, there are many factors that influence a person's mathematical thinking habits. As argued by (Gordon, 2011), including mathematical thinking habits in mathematics learning is not an easy thing. Based on this opinion and based on the results of the analysis and research findings found, it is hoped that mathematics education students will be able to change mathematical thinking habits in learning mathematics and lecturers can provide and facilitate good mathematical thinking habits for students so that students' mathematical thinking habits develop and have an impact on students' mathematical abilities increase.

Conclusion

The mathematical thinking habits of mathematics education students have an overall percentage score of 68.43% in the good category. Meanwhile, the indicators, namely flexible thinking and metacognitive thinking, each have a percentage score of 69.90% and 71.36%, all of which are in the good category. Meanwhile, thinking and communicating clearly and precisely has a percentage score of 63.6% in the sufficient category.

In future researchers, it is hoped that the results of the survey regarding mathematical thinking habits can provide innovation in mathematics learning so that

habits that have a positive influence on students can develop and have an impact on increasing students' mathematical abilities, especially in mathematical abilities.

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