

Thingking's Metaphorical Learning Model to Improve Reflective Thinking Skills in Mathematics

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Abstract

The ability of PGSD study program students in elementary school mathematics learning courses is still lacking, especially in reflective thinking skills. To overcome this, efforts are needed to improve students' reflective thinking skills; therefore, this article describes efforts to enhance reflective thinking skills with the metaphorical thinking learning model, learning that emphasizes students' activities to think metaphorically in finding an idea to link problems in questions with everyday experiences, metaphorical thinking is a model that bridges abstract concepts into more concrete things, Metaphorical thinking is a thinking process that uses metaphors to understand a metaphorical thinking concept called metaphorming, it is concluded that this study shows that the metaphorical thinking learning model improves reflective thinking skills in mathematics.,

Keywords: Metaphorical Learning, Reflective, Thinking Ability, Mathematics.

INTRODUCTION

In the current era of globalization in the 21st century, the progress of science and technology is developing very rapidly. Every human being cannot be separated from the digital world. The various innovations impact all areas of life, one of which is in the field of education. Education is one of the basic needs in human life, and it is used to think about how to live this worldly life to maintain life (Subandowo, 2022). Education is also a tool to develop self-potential,

130

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namely competencies related to the ability to think, behave, and act.

The metaphorical thinking approach is inherently student-centered. This approach encourages learners to engage in metaphorical thinking activities, finding ways to relate problems to everyday life. Metaphorical thinking is a mental activity that connects seemingly unrelated subjects or things, making it a fascinating and engaging process for students.

Mathematics learning must be carried out in a more directed and orderly manner through solving mathematics problems to improve students' attitudes in a better direction. However, in reality, the mathematics learning process is still dull; teachers who like to get angry explain the material only through lectures, then students are asked to take notes and do it. The trigger for boredom in learning is usually because students only sit, listen, take notes, and load material that is difficult to understand (Yuni et al., 2021).

Education is an effort to develop and facilitate human resources to achieve their desired life goals. With education, the potential can be explored and developed so that humans can improve their quality or quantity. Education includes various fields that are interrelated with each other, one of which is mathematics. Mathematics is a discipline that can improve the ability to think and argue, contribute to solving daily problems, and support the development of science and technology. One of the characteristics of mathematics is that it has an abstract object of study consisting of facts, concepts, principles, and operations. So, the best way for students to start learning concepts and principles in mathematics is to construct the concepts and principles learned on their own (Cahirati et al., 2020).

According to Good (Dictionary of Education) in Ahmadi, Education is the art, practice, or profession of teaching (teaching), systematic knowledge, or teaching that deals with the principles and methods of teaching, supervision, and guidance of students. Education as an art means that education must take place according to the characteristics and needs of each individual (student) (Almareza, 2021). A person needs reflective thinking skills because reflective thinking is the process of connecting previously owned information with what is being learned, leading a person to solve problems persistently (Nirfayanti & Nurdiah, 2023).

Potential development is a significant effort in education and has even become the essence of education efforts (Amaliyah & Rahmat, 2021). This is in line with Law 20 of 2003 article 1, paragraph 1, which states that education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious, spiritual strength, self-control, personality, intelligence, noble morals, and skills needed by themselves, society, nation and state (Junaedi, 2019).



The learner's mathematical concept is Metaphorical Thinking. Metaphorical thinking uses metaphors or analogies to make it easier for students to understand and absorb specific material or information. Metaphorical thinking in mathematics is used to clarify a person's way of thinking connected to his mathematical activities. Abstract concepts organized through metaphorical thinking are expressed in concrete terms based on the structure and way of reasoning based on a sensory-motor system called conceptual metaphor (Elfia Sukma binti Bachtiar, 2021).

The quality of mathematics learning is highly considered to improve Education in Indonesia. This is known from the number of hours of mathematics lessons in schools, which are more than other lesson hours. Mathematics education depicts how mathematics can be applied in real life. According to the National Council of Teacher Mathematics, there are five mathematical abilities in the implementation of mathematics learning, including 1) problem-solving skills, (2) reasoning and proof, (3) communication, (4) connection, and (5) Representation (Fatmawati et al., 2023).

This is in line with Werdiningsih & Khoerunisa (2021), who say that the ability to think must be possessed and developed as the ability to think mathematically. Reflective thinking is an awareness of what is known and what is needed; this is very important to bridge a person in solving problems. Thinking mathematically reflectively is one of the skills needed in mathematics learning. A person needs reflective thinking skills because reflective thinking connects previously owned information with what is being learned, leading a person to solve problems persistently (Nirfayanti & Nurdiah, 2023).

The importance of getting used to learning activities in a cumulative mathematical disposition will foster a strong desire to learn in the individual concerned. In subsequent development, possessing a high learning disposition in individuals will form a resilient, tenacious, responsible individual, have high achievement motives, and help individuals achieve their best results (Lessa Roesdiana, 2020).

Meanwhile, based on the results of the researchers' observations at the Elementary School Teacher Education Study Program (PGSD) of Megarezky University, it was obtained that the pattern of the learning system implemented was centered on institutions or lecturers. Lecturers tend to be more active than students or are *teacher-centered*, so students just attend lectures. In addition, lecturers do not provide stimuli that can stimulate the ability to think reflectively, which is to be achieved in learning. Lecturers do not know what students' initial abilities in mathematics learning are. Therefore, an effective mathematics learning process has not been achieved. One of the learning models that is by the learning characteristics of constructivism, cognitivism, and



reflective thinking skills is learning that emphasizes the relationship between mathematics and real phenomena that exist around according to Holyoak & Thagard, among others: *Metaphorical thinking* (Payadnya, 2020).

Thinking metaphorically in mathematics begins with creating a mathematical model based on a context. The use of metaphors in mathematics learning by students is a way to connect mathematical concepts with the conditions that students have experienced in the real-world context around students, either in the form of experiences or new contexts for students. Metaphorical ability is analogizing abstract concepts into a more tangible context (Nurjasia et al., 2021). In line with Wulandari (2019), one of the learning objectives of *Metaphorical thinking* is understanding concepts mathematically, explaining between concepts, and applying concepts flexibly, accurately, efficiently, and appropriately in solving problems.

The thought process of *Metaphorical Thinking* uses metaphors to understand a concept, where the metaphors move from a concept the student has learned to another that he has not learned or the concept he is learning. The characteristic of the metaphorical thinking approach is to bridge or connect abstract concepts into something more concrete. *Metaphorical thinking* can be an alternative to improving students' mathematical reflective thinking skills (Zafira, 2024).

Selection of learning models *Metaphorical thinking* This is not done without consideration. In addition to this model being able to make students more actively participate in learning in the classroom, this model has also been proven to be effective in overcoming students' low mathematical skills. Problem-solving skills and mathematical resilience of students taught with the learning model *Metaphorical thinking* higher than conventionally taught learning (Fransiska et al., 2022). Mathematical critical thinking skills of students whose learning uses *Metaphorical thinking* better than those whose learning does not use *Metaphorical thinking* (Abdullah, 2023); Wahid et al., 2024).

METHOD

This research is a pseudo-experimental research with a free experimental design. This research was conducted at Megarezky University in the elementary school teacher education study program (PGSD). The population in this study is PGSD study program students who take elementary mathematics learning courses with 120 students. Sampling was done using a simple random sampling technique so that a class of 32 students was selected for the fourth semester. The test data of learning outcomes and reflective thinking skills obtained were analyzed using statistical tests. Data analysis began with a normality and homogeneity test, then was tested with



parametric statistics, namely the t-test, with an error level of 5%.

RESULTS AND DISCUSSION

Based on student activities from the first meeting to the fifth meeting, there has been an increase in using *the metaphorical thinking learning model*; each meeting has increased in activity in the steps or syntax of the learning model. The results of the analysis of student activities can be seen in the following table 1.

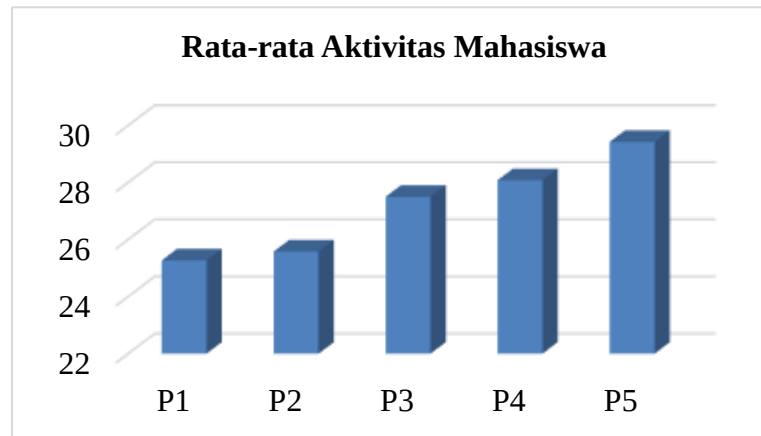
Table 1. Results of Student Activities with Metaphorical Thinking Learning Model

Meeting	Average Activity
P1	25,27
P2	25,58
P3	27,50
P4	28,08
P5	29,42
Total	135,85
Average	27,17
Percentage	84,91%

Based on the above, it is known that the percentage of student activity in learning that applies *the metaphorical thinking learning model* of 84.91% is in the interval of 80-100% with the outstanding category. When viewed from the indicators of student activity, the percentage of student activities in the learning community is 81.00%, and student activities outside the learning community are 88.00%.

The description of the average results of student activities carried out at Megarezky University in elementary mathematics learning lectures is as follows.





Picture 1. Student Activities

Based on the diagram above shows that there is an increase from the first meeting to the fifth meeting, using the *metaphorical learning* model. The average result of overall student activity was 27.17, with a percentage of 84.91% in the outstanding category.

The measurement of reflective thinking skills uses one instrument: the learning outcome test. The learning outcome test is a description test consisting of 5 questions, including measuring students' reflective thinking skills. The results of the analysis of students' learning outcomes and reflective thinking skills are explained in the following table.

Table 2. Frequency Distribution and Percentage of Reflective Thinking Ability

Interval	Frequency	Percentage (%)	Category
$85 \leq KBR \leq 100$	7	21,87	Excellent
$75 \leq KBR < 85$	16	50,00	Good
$65 \leq KBR < 75$	8	25,00	Pretty Good
$55 \leq KBR < 65$	1	3,13	Not Good
$KBR < 55$	0	0	Bad
Sum	32	100	

The frequency and percentage distribution results showed that students' reflective thinking skills using the *metaphorical learning model* were 21.87% in the outstanding category, 50.00% in the good category, 25.00% in the good category, and 3.13% in the poor category. This shows that the average value of the overall reflective thinking ability is 80.00 in the good category.

The distribution of student graduation frequency in elementary mathematics learning courses is in the following table:

Table 3. Distribution of Student Acquisition Frequency

Number	Information	Frequency	Percentage (%)
1	Pass	31	97,00
2	Not Passing	1	3,00
Sum		32	100

Based on the table above shows the learning results of students' reflective thinking skills with the *metaphorical learning model*; namely, as many as 31 students out of 32 students were declared to have passed with 97.00%, and there was 1 person who was declared not to have passed by 3.00%. This shows that learning activities were declared successful because more than 85% of students met the requirements of more than 85% of students to achieve or above the applied graduation score.

Table 4. Table of N-Gain Analysis Results

Number	Information	Value	Category
1	N-Gain Score	0,71	Keep
2	N-Gain Score (%)	71,15	Quite Effective

The pretest and posttest data analysis resulted in an N-Gain value of 0.71, which is included in the medium category. Furthermore, the percentage of effectiveness based on the interpretation of N-Gain reached 71.15%, which is also quite effective. This data supports the conclusion that *the metaphorical learning model* effectively improves students' reflective thinking skills.

After data processing, an inferential analysis was then carried out. Before testing the hypothesis, a normality test will be performed to ensure that the data meets the normality assumptions required in the hypothesis test.

Normality tests are performed before hypothesis testing to ensure the data is distributed normally. With a p-value = 0.123, it is concluded that the data is normally distributed, then the homogeneity test of the p-value = 0.214, it is concluded that the data is homogeneous; thus, the regular and homogeneous data meet the statistical assumptions for further testing. After meeting



the prerequisite test, the analysis is followed by a t-test to test the research hypothesis. A one-sample t-test will be conducted by comparing the average score before and after the treatment to determine if there is a significant improvement in students' reflective thinking skills.

**Table 5. Significance of improving the ability to Reflective Thinking
One-Sample Test**

	Test Value = 32					
	t	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Snoop Doggy	43.497	31	.000	48.00000	45.7494	50.2506

Based on the table above, the results of the one-sample t-test show that the p-value = 0.000 is smaller than α (0.05), so H_0 is rejected. This reinforces that *the metaphorical learning model significantly improves students' thinking skills*.

The lecture results illustrate that the *metaphorical learning model improves students' thinking skills*, which is accompanied by increased student activities in each meeting. Improving this thinking ability is by the characteristics of *the metaphorical thinking learning model*, which encourages students to connect abstract concepts with concrete experiences through metaphor so that the material learned becomes easier to understand, meaningful, and applicable. This is in line with the cognitive theory by Ausubel. A metaphor is an initial hook that can help students understand complex or abstract concepts by comparing them with something familiar. The theory of *multiple intelligences* (Howard Gardner) encourages students to use language creatively and establish relationships between concepts and individuals through discussion and presentation of ideas.

The *metaphorical learning model of things improves thinking skills*. Reflecting on mathematics, learning is the ability to relate learning to daily life and metaphorically teach it. This is in line with research conducted by Lakoff & Johnson (1980), Setiawan & Wibowo (2018), and Rahman (2020). *Metaphorical thinking* can improve the way of thinking and understanding concepts.

By relating mathematical concepts to relevant contexts and metaphors, students can improve their thinking skills and apply them in their daily lives.



CONCLUSION

The metaphorical thinking *learning model* effectively improves the quality of students' activities and reflective thinking skills in elementary mathematics learning courses. Student activity increases gradually at each meeting, characterized by active involvement in group discussions, courage to express opinions, and the ability to relate mathematical material with relevant concrete experiences.

This improvement aligns with the learning model's syntax that encourages students to think through an analogy and metaphor approach. Students can reflect on learning well, understanding concepts, and interpreting and applying them daily. Cognitively, this model helps students map abstract concepts to be more meaningful. Students actively receive and construct creative and reflective thinking.

Based on data on learning outcomes, classroom activities, and statistical testing, it can be concluded that *using metaphorical thinking* not only supports the achievement of learning outcomes but also creates a more lively, participatory, and conceptually meaningful lecture atmosphere.

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