

## The Role of Scaffolding Strategy as an Alternative to Improve Students' Mathematical Thinking Skills at SD Negeri 3 Kalipelus

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### ABSTRACT

Mathematics is a universal science that has a major role in the development of knowledge, technology, and information (Sutarsa, 2021). It serves as the foundation for various disciplines, as every field of science inherently involves mathematics. Therefore, mathematics is taught at every level of education in Indonesia, from elementary schools to universities, to foster and develop students' abilities in logical, analytical, systematic, critical, and creative thinking, as well as their collaboration skills. One of the mathematical competencies expected to be developed in schools is students' mathematical thinking ability. This includes critical thinking, problem-solving, mathematical connections, mathematical reasoning, and creative thinking skills (Silviana, 2021). Background from this watchfulness because the ability of Class V students at SD Negeri 3 Kalipelus to solve mathematics problems remains relatively low, Students' critical thinking skills are underdeveloped, as teachers tend to pay limited attention to how students respond to the problems, Students' lack of active involvement often leads to their exclusion, which hinders the development of their mathematical critical thinking skills, Students still experience difficulties in identifying the relevant concepts, especially when the given problems involve more than one concept. Therefore, one of the alternative instructional strategies that teachers can apply to support students in the learning process is the scaffolding strategy. Scaffolding is a strategy that serves to bridge the gap between students' existing knowledge and the new knowledge they are expected to acquire. Scaffolding is considered an effective and appropriate strategy for teachers to use when assisting students in solving mathematical problems. This is supported by research conducted by Yuntawati, titled "The Effectiveness of Scaffolding on Improving Mathematical Problem-Solving Ability." The study yielded positive results, showing a significant difference in problem-solving abilities between the class that received scaffolding and the class that did not, indicating that scaffolding was effective in enhancing students' mathematical problem-solving skills in that study.

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## 1. INTRODUCTION

### Mathematical Critical Thinking Skills

According to the *Kamus Besar Bahasa Indonesia* (Indonesian Dictionary), the root word *pikir* (thought or reason) refers to reason, memory, or imagination. The term *berpikir* (thinking) means to use reason to consider and decide on something, or to reflect through memory. *Berpikiran* (having thoughts or possessing reason) means having thoughts or possessing reason; *pikiran* (thought) refers to the result of thinking; *pemikiran* (thinking process or reasoning) denotes the process, method, or act of thinking; and *pemikir* (thinker) is defined as a person who is intelligent and wise, whose thoughts are beneficial to others. Everyone naturally thinks when faced with a problem; however, each individual possesses different levels of competence (Indriyani, 2019). When students are presented with mathematical problems, they are able to train themselves to use their thinking skills. This process allows us to identify the level of thinking possessed by each student. Thinking ability refers to the capacity to process information mentally or cognitively, ranging from lower-order to higher-order levels. Sternberg defines critical thinking as a mental activity, strategy, and representation used by individuals to solve problems, make decisions, and learn new concepts (Rosalina, 2018). Daniel T. Willingham, as cited in (Dewantari et al., 2023), states that critical thinking is the ability to systematically examine acquired information, understand various arguments, and draw conclusions based on available evidence. The purpose of critical thinking is to gain understanding and make better decisions.

According to Sulistiani, as cited in (Setiawan, 2024), a person who thinks critically has the following characteristics: (1) the ability to think rationally in responding to a problem; (2) the ability to make appropriate decisions in solving problems; (3) the capacity to analyze, organize, and explore information based on available facts; and (4) the ability to draw conclusions and construct arguments correctly and systematically.

This study adopts four indicators of critical thinking adapted from Facione (as cited in Anike), namely: (1) Interpretation, which refers to the ability to understand, explain, and clearly assign meaning to data or information; (2) Analysis, which refers to the ability to identify relationships among pieces of information used to express thoughts or opinions; (3) Evaluation, which refers to the ability to examine and test each process to determine its accuracy or truth; and (4) Inference, which refers to the ability to identify and obtain the elements necessary to draw a reasonable conclusion. Therefore, the researcher will adopt these four indicators proposed by Facione as the indicators of critical thinking (Putri A. , 2018).

### Scaffolding Strategy

The concept of scaffolding in education was first introduced by Vygotsky, a Russian psychologist, and later popularized by Bruner, an expert in mathematics education. According to Vygotsky, students develop higher-order thinking skills when they receive guidance (scaffolding) from someone more knowledgeable, such as a teacher or a more capable peer (Chairani, 2015). Based on this explanation, the scaffolding strategy can be defined as the provision of assistance, support, or guidance given to students by a more competent or mature individual, particularly a teacher, through gradual steps. This process aims to develop students' actual abilities toward their potential capabilities so that they can eventually solve more complex problems independently.

The scaffolding strategy needs to be implemented in the problem-solving process because when students encounter difficulties in solving problems, the teacher can provide initial assistance in the form of prompts, encouragement, examples, step-by-step guidance, or other forms of support. This allows students to connect the assistance provided by the teacher with the process of solving the problem (Nurhalita, Darma, & Haryadi, 2020). Scaffolding is provided by the teacher by offering a substantial amount of support in the initial stages, which is then gradually reduced until students are eventually able to work independently. Through learning that incorporates the scaffolding strategy, students are expected to improve their metacognitive skills and gain a deeper understanding of mathematical concepts. This is achieved because students construct their knowledge structures of mathematical concepts with the help and guidance of the teacher.

There are two key principles proposed in Vygotsky's theory: (1) the function and significance of language in social communication, which begins with the sensory recognition of signs and extends to the exchange of information and knowledge; and (2) the ZPD, in which the teacher, as a mediator, plays a role in encouraging and bridging students' efforts to build knowledge, understanding, and competence.

According to Vygotsky's theory, children's cognitive functions are closely connected to social and cultural contexts. As a result, children can develop concepts in a systematic, logical, and rational manner through their interactions with society. Vygotsky states that learning occurs when children are working within their Zone of Proximal Development. This zone refers to the area between the actual level of development, which is defined as the ability to solve problems independently, and the potential level of development, which is defined as the ability to solve problems under the guidance of an adult or a more capable peer. Based on this theory, it can be concluded that the ZPD represents a task that is difficult for a child to learn independently but can be achieved with assistance from someone more experienced or knowledgeable. There are several advantages to learning the

scaffolding strategy, including: motivating and connecting students' interests to the learning tasks; simplifying learning tasks so they become more manageable and achievable for students; providing guidance to help students stay focused on achieving the learning objectives; clearly demonstrating the difference between students' work and the expected or standard solutions; reducing frustration or risk; offering models and clearly defining expectations regarding the activities to be performed.

## 2. METHOD OF THE RESEARCH

This study will use a qualitative approach. Moleong defines qualitative research as an inquiry aimed at understanding phenomena experienced by research subjects as a whole, described in the form of words and language, utilizing naturalistic methods. This qualitative research method is often referred to as the naturalistic research method because it is conducted in natural settings. It is also known as the ethnographic method because it was initially widely applied in the field of cultural anthropology. Furthermore, it is called the qualitative method because the data collected and the analysis are predominantly qualitative (Afifudin & Saebani, 2012). This study will be classified as library research, in which the object of study will be based on literature sources such as books. The research will be conducted by reading, reviewing, and analyzing various existing literature, including books and previous research findings.

The subjects of this study will be all Class V students of SD Negeri 3 Kalipelus, Purwanegara District, Banjarnegara Regency. The data collection technique that will be used in this study is the library research method. Library research involves studying literature by reading books, journals, and other reference sources available in the library. This research activity will be carried out by collecting data from various sources of literature, not limited to books but also including documentation materials, journals, newspapers, and others. This method does not require the researcher to go directly into the field to observe facts as they are. In addition, the researcher will also use the comparative method, which aims to determine the causes or reasons for differences by comparing one opinion with another. The following are examples of assessment instruments that will be used: The following are examples of assessment instruments that will be used, Observation, Student Perception Questionnaire, Teacher Interviews, Analysis of Student Work,

## 3. RESULT AND DISCUSSION

This study aims to explore how scaffolding strategies can enhance students' mathematical critical thinking skills, particularly among Class V students at SD Negeri 3 Kalipelus. Through an extensive review of literature and comparative analysis of expert opinions and prior research findings, several key points have emerged. Mathematical critical thinking encompasses higher-order thinking abilities that allow students to interpret problems, analyze information, evaluate reasoning processes, and draw logical inferences. Based on the indicators proposed by Facione—interpretation, analysis, evaluation, and inference—students can develop a structured framework for approaching mathematical problems. Research by Putri (2018) supports that students with strong critical thinking abilities tend to perform better in mathematics due to their capability to evaluate different problem-solving strategies and choose the most effective one. Similarly, Dewantari et al. (2023) emphasized the importance of systematic reasoning and evidence-based conclusions, which are essential skills in mathematical problem solving.

Scaffolding, as introduced by Vygotsky and developed further by Bruner, is a powerful strategy to bridge the gap between what students can do independently and what they can achieve with guidance. Within the Zone of Proximal Development (ZPD), students benefit from structured assistance provided by teachers, which is gradually withdrawn as competence increases. Nurhalita et al. (2020) noted that scaffolding helps students link prior knowledge with new concepts, allowing for a deeper understanding of mathematical structures. Teachers can implement scaffolding through various means such as guided questions, prompts, step-by-step modeling, and feedback. When applied consistently, this approach can foster students' metacognitive awareness and encourage them to engage in reflective thinking. Based on literature findings and the context of Class V students, scaffolding strategies are particularly relevant for supporting students who may struggle with abstract mathematical concepts. By providing structured support tailored to each student's current level, teachers can nurture their critical thinking gradually. Moreover, the implementation of scaffolding can also address the diverse cognitive readiness levels observed among students. For example, less confident students may benefit from modeling and guided practice, while more advanced students can be challenged through probing questions that stimulate evaluation and inference.

The integration of Facione's critical thinking indicators with Vygotsky's scaffolding principles creates a comprehensive instructional framework. In this framework, **interpretation and analysis** are facilitated through guided exploration of mathematical problems, **evaluation** is supported through teacher feedback and peer discussion, and **inference** is strengthened as students attempt to solve problems with decreasing support. The findings align with the view that critical thinking is not an innate skill but one that can be cultivated through

intentional teaching strategies. Consequently, this study supports the conclusion that the scaffolding strategy is effective in fostering mathematical critical thinking in elementary school students.

#### 4. CONCLUSION

Based on the findings from the literature review and comparative analysis, it can be concluded that mathematical critical thinking skills—comprising interpretation, analysis, evaluation, and inference—are essential components of effective mathematics learning, particularly for elementary school students. These skills enable students to solve problems systematically, make informed decisions, and build a deeper understanding of mathematical concepts. The use of **scaffolding strategies**, as grounded in Vygotsky's theory of the Zone of Proximal Development (ZPD), plays a crucial role in developing students' critical thinking. Scaffolding provides structured support that helps students bridge the gap between their actual abilities and potential capabilities. As students receive appropriate guidance and gradually become more independent, their ability to think critically improves significantly. For Class V students at SD Negeri 3 Kalipelus, the application of scaffolding strategies in mathematics instruction is highly recommended. These strategies not only enhance students' cognitive engagement but also foster confidence and independence in solving mathematical problems. Therefore, it is essential for educators to integrate scaffolding techniques into their teaching practices to support the development of students' mathematical critical thinking skills and promote deeper, more meaningful learning experiences.

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