

# ANALYSIS OF COGNITIVE BARRIERS IN CHILDREN'S UNDERSTANDING OF MATHEMATICS LEARNING CONCEPTS

## **Nurfazyelah**

Sekolah Tinggi Agama Islam Al-Gazali Bulukumba, Indonesia

Email: [nurfazyelah69@gmail.com](mailto:nurfazyelah69@gmail.com)

## **Cahya Imani**

Sekolah Tinggi Agama Islam Al-Gazali Bulukumba, Indonesia

Email: [cahyaimani964@gmail.com](mailto:cahyaimani964@gmail.com)

## **Nurul Hidayah**

Sekolah Tinggi Agama Islam Al-Gazali Bulukumba, Indonesia

Email: [nurulhidayahahhar@gmail.com](mailto:nurulhidayahahhar@gmail.com)

## **Nurul Mutahara**

Sekolah Tinggi Agama Islam Al-Gazali Bulukumba, Indonesia

Email: [nn8751919@gmail.com](mailto:nn8751919@gmail.com)

## **Ana Safitri**

Sekolah Tinggi Agama Islam Al-Gazali Bulukumba, Indonesia

Email: [nanaaaa2310@gmail.com](mailto:nanaaaa2310@gmail.com)

## **Abrar Abira**

Sekolah Tinggi Agama Islam Al-Gazali Bulukumba, Indonesia

Email: [abraabira09@gmail.com](mailto:abraabira09@gmail.com)

## **ABSTRACT**

*This study aims to analyze the cognitive obstacles experienced by elementary school students in understanding mathematical concepts. Cognitive obstacles refer to difficulties that arise from students' limited thinking processes in connecting abstract mathematical ideas with their concrete experiences. Through a case study conducted by reviewing various educational and cognitive psychology literature, it was found that factors such as low logical reasoning ability, insufficient understanding of basic concepts, and the use of less varied instructional methods are the primary causes of students' cognitive barriers. In addition, low learning*

*motivation and the limited use of interactive learning media further intensify students' difficulties in comprehending mathematical concepts. Efforts that teachers can undertake include implementing contextual learning strategies, using concrete learning media, providing individual guidance, and fostering reflective thinking in order that students can construct their conceptual understanding independently. Therefore, this analysis is expected to provide meaningful contributions to the development of more effective mathematics learning approaches in elementary schools.*

**Keywords:** *Cognitive Barriers, Conceptual Understanding, Mathematics Learning, Elementary School*

**How to Cite** Nurfazyelah, N., Imani, C., Hidayah, N., Mutahara, N., Safitri, A., & Abira, A. (2026). Analysis of Cognitive Barriers in Children's Understanding of Mathematics Learning Concepts. *Al-Mubtadi: Jurnal Pendidikan Guru Madrasah Ibtidaiyah*, 3(2), 384–392.  
<https://doi.org/10.58988/almubtadi.v3i2.869>

## INTRODUCTION

Mathematics is an important subject taught from elementary school to college (Karlina et al., 2024). This subject serves to equip students to solve various daily problems (Deputy, 2023) and develop analytical, critical, logical and creative thinking skills needed in decision making (Yuliawan et al., 2024) Therefore, strengthening mathematical understanding from an early age, especially in elementary school, is highly important as a foundation for understanding more complex concepts at the next level (Anggraini, 2021). The main goal of learning mathematics is not only to master content or knowledge, but also to achieve competency, namely the ability of students to think and solve problems mathematically (Rafiah et al., 2018).

However, mathematics learning in elementary schools still faces various obstacles. Many students have difficulty understanding concepts, have low interest in learning, and lack a variety of learning methods (Siregar et al., 2024). Students often consider mathematics difficult and boring, thus their motivation to learn decreases (Dwi & Audina, 2021) This is partly due to the abstract nature of mathematics, while students are still at the concrete operational cognitive development stage according to Piaget (Unaenah et al.,

2022) As a result, students have difficulty understanding the material and are less active in learning.

Learning barriers impact students' academic achievement. Each student has different learning characteristics, thus the barriers they experience also vary (Ghufron & Risnawita, 2015). Learning disabilities may also be caused by disorders in the child's brain nervous system, which can affect the development of the child's thought patterns (Setyawan et al., 2019). Learning barriers can also be caused by genetics and the student's environment, the student's lack of willingness to change good habits for learning, and the involvement of parents in student tutoring at home (Arum et al., 2022). Low student interest in learning will influence student learning barriers, this interest in learning can be influenced by the media and the explanation of the material presented (Rizaldy et al., 2022). Learning barriers are the presence of obstacles (barriers) that can hinder a student's learning process. Elementary school students often encounter learning barriers, including those affecting their writing, reading, and arithmetic skills (Husein, 2020). Obstacles are also defined as difficulties experienced by students as a form of impact of the learning process which is still dominated by the teacher, not providing space to activate students' abilities which often results in misconceptions among students (Dharma et al., 2021).

To improve elementary school students' math skills, learning strategies that encourage more active participation must be implemented. Implementing appropriate learning models will help students learn better (Tampuh et al., 2024). This is one way to address learning outcomes. One way to address these teaching challenges in elementary schools is to use a context-based teaching approach (Abrar, 2003). Teachers play an important role in helping students overcome learning barriers in elementary school (Ismail, 2016). Low interest in learning influences learning barriers; interest can be influenced by media and the way teachers explain the material (Rizaldy et al., 2022). Learning barriers often arise in basic skills such as writing, reading, and arithmetic at the elementary school level (Husein, 2020). Learning barriers can be overcome through stimulus, motivation, guidance, and supervision of student learning (Mursalin, 2021).

Other factors such as less varied learning methods and low learning motivation also worsen students' understanding (Muhibbin, 2019) Therefore, teachers need to analyze cognitive barriers in order to implement appropriate and engaging learning strategies in order that students can more easily understand mathematical concepts (Suherman, 2003). By understanding the causes of cognitive barriers, teachers can determine more effective teaching methods, for example through the use of concrete media, learning based on everyday life contexts, and individual guidance for students who experience difficulties. The purpose of this study was to determine the effect of cognitive barriers on students' ability to understand mathematical concepts in elementary school, as well as to identify effective learning strategies to overcome these cognitive barriers in order that students can more easily understand mathematical concepts and improve their logical thinking and problem-solving abilities.

## **METHOD**

This study employed a descriptive qualitative method with a case study approach. This method was chosen to achieve a deeper understanding of the cognitive barriers experienced by lower-grade students in internalizing the concept of multiplication as addition and repetition, and to identify the factors that influence them. This study did not aim to measure students' abilities quantitatively, but rather to understand the thought processes and difficulties faced by students in understanding the basic concept of multiplication in the context of elementary school mathematics learning. According to Sugiyono (2019), qualitative research aims to understand phenomena in depth and emphasizes meaning over numbers. A descriptive approach is used to describe the actual conditions of students' cognitive barriers in learning mathematics. Qualitative research is used to understand the phenomena experienced by research subjects holistically and describe them in words.

This research employed a case study approach to explore and understand phenomena in depth within the context of second-grade elementary school students. Case studies allow researchers to examine in detail the learning process, barriers to thinking, and interactions between students and teachers during the learning

process. According to Asstakurrohim et al. (2022), case studies aim to uncover the hidden reality behind a phenomenon in order that it can be understood comprehensively and contextually. The data collection methods used in this qualitative descriptive study included observation and interviews. Observations were conducted to gain an understanding of the obstacles associated with students' difficulties in learning mathematics in elementary school. Interviews were conducted with teachers to obtain their perspectives on the problem.

## **RESULTS AND DISCUSSION**

Research on students' cognitive barriers in understanding the concept of learning mathematics in class shows that these barriers mostly stem from limited cognitive development and the use of inadequate learning media (Adita & Napitupulu, 2023). Based on Piaget's cognitive development theory, students in the concrete operational phase still require physical stimuli to process and understand abstract mathematical concepts. In this context, learning media serves as a link between concrete objects and theoretical concepts. However, when media are unavailable or not utilized optimally, the connection between concrete experiences and abstract understanding is broken. This situation ultimately forces students to understand mathematical material at an abstract level without adequate conceptual support, thus triggering various learning difficulties.

The difficulties experienced by students in learning mathematics are not only limited to problem solving. These obstacles also appear in indicators of difficulty in understanding mathematical concepts, namely: (1) difficulty in choosing the right formula to solve the problem, and (2) students' inaccuracy in applying the formula according to the conditions for the formula to be valid or not writing the formula at all (Darjani et al., 2015). As a result, many students neglect to write formulas correctly and appropriately for the material being studied and its application.

According to Piaget, as explained by (Setyawan et al., 2019), a child's cognitive development is influenced by four main factors. First, the maturity of the brain and nervous system, which are innate aspects that determine a child's biological readiness to learn and understand new information. Second, physical and logical-

mathematical experiences, where a child's direct interaction with the environment and abstract thought processes help build their cognitive structure. Third, social interaction, which includes guidance, communication, and the exchange of views with others, allows children to expand their ways of thinking. Fourth, the process of equilibration or balance, which is a child's ability to adjust and align new information with existing knowledge, resulting in more stable and mature cognitive development.

(Munir & Maemonah, 2023), explains that there are several approaches that can be used to help restore the abilities of elementary school students who experience difficulties in understanding mathematical concepts and which impact their cognitive development. First, the territorial method, which is a method that requires a special assistant who is competent in dealing with mathematical learning difficulties (Andriani et al., 2025). This approach is usually carried out through simple counting exercises using hands or other concrete tools to strengthen basic understanding. Second, the visual method, which is a strategy that starts learning from concrete objects to more abstract concepts. This can be done by providing illustrations or pictures without numbers, accompanied by verbal explanations to help students connect visuals with mathematical ideas. Third, the repeated practice method, which provides opportunities for students to continue practicing and repeating the material so that their understanding becomes stronger and more stable.

Data analysis through observation, interviews, and document review revealed significant differences in students' learning abilities in the subjects studied. The majority of students were able to follow the lessons effectively, understand the teacher's explanations, and respond positively to the material presented. However, some students still required additional assistance due to difficulty understanding concepts, repeated explanations, and a tendency to exhibit low learning motivation.

Observations also show that the learning environment, the strategies used by teachers, and students' readiness and basic abilities play a role in determining learning success. Variations in learning styles and differences in cognitive abilities mean that each student requires a different learning approach. These findings confirm that

the learning process is determined not only by materials and methods, but also by each student's individual learning characteristics. Therefore, before discussing the learning difficulties experienced by children in more detail, it is necessary to understand the general state of learning achievement and the factors that influence the learning process.

## CONCLUSION

Based on the research results, it can be concluded that the cognitive barriers experienced by elementary school students in understanding mathematical concepts are primarily influenced by limited development of thinking skills and the lack of adequate use of learning media. Students at the concrete operational stage require concrete stimuli to bridge abstract mathematical concepts. When learning media are unavailable or not utilized optimally, the process of connecting concrete experiences and abstract understanding is disrupted, resulting in various learning difficulties. The barriers that arise are characterized by difficulty selecting and applying formulas correctly according to applicable provisions. Factors that influence cognitive development include biological maturity, physical and logical-mathematical experience, social interaction, and the process of balancing knowledge. Several approaches can be applied to assist students, including territorial methods, visual methods, and repeated practice to strengthen conceptual understanding. Overall, learning success is influenced by student readiness, teacher strategies, and the learning environment. Therefore, a proper analysis of cognitive barriers is necessary so that the learning strategies applied can help students understand mathematical concepts more effectively. Further research is needed to test the effectiveness of these learning strategies in different classroom contexts.

## REFERENCES

- Abrar Abira, (2003) Wahana Ilmiah Pendidikan Dasar 9 (1), 218-228.
- Andriani, A., Al Ayyubi, I. I., Nurhikmah, Prayetno, E., & Khan, A. (2025). Pembelajaran Matematika pada Faktor Persekutuan Terbesar dan Kelipatan Persekutuan Terkecil di Sekolah Dasar. *Journal of Primary Education Research*, 3(1), 7–13. <https://doi.org/10.57176/primer.v3i1.42>

- Anggraini, R. (2021). *Pembelajaran Matematika di Sekolah Dasar*. Jakarta: PT Gramedia.
- Arum, N. W., Kusumawati, D., & Rahmawati, F. (2022). Faktor genetik dan lingkungan terhadap hambatan belajar siswa. *Jurnal Pendidikan Dasar*, 7(1), 45–55.
- Darjiani, N. L. P., Suryaningrat, E. N., & Putri, I. K. R. (2015). Analisis Kesulitan Belajar Matematika pada Siswa SMP. *Jurnal Pendidikan dan Pembelajaran Matematika*, 2(1), 45–52.
- Dharma, M., Kamid, & Yantoro. (2021). Analisis miskonsepsi siswa dalam pembelajaran matematika sekolah dasar. *Jurnal Kajian Pendidikan*, 12(2), 133–142.
- Dwi, L., & Audina, A. (2021). Minat belajar siswa pada pembelajaran matematika di sekolah dasar. *Jurnal Cakrawala Pendidikan*, 40(3), 601–610.
- Ghufro, M. N., & Risnawita, R. (2015). *Gaya Belajar dan Kesulitan Belajar*. Yogyakarta: Pustaka Pelajar.
- Husein, M. (2020). Hambatan belajar siswa sekolah dasar dalam kemampuan dasar membaca, menulis, dan berhitung. *Jurnal Pendidikan Dasar Nusantara*, 5(2), 78–86.
- Ismail. (2016). Peran guru dalam mengatasi hambatan belajar siswa sekolah dasar. *Jurnal Edukasi*, 4(1), 22–30.
- Karlina, D., Putri, A., & Rahman, S. (2024). Pentingnya pembelajaran matematika dalam kehidupan sehari-hari. *Jurnal Pendidikan Indonesia*, 9(1), 11–20.
- Mulyani Sumantri. (2011). *Pengembangan Pembelajaran*. Jakarta: Universitas Terbuka.
- Mursalin. (2021). Strategi guru dalam mengatasi hambatan belajar siswa. *Jurnal Ilmiah Pendidikan*, 8(2), 54–62.
- Muhibbin Syah. (2019). *Psikologi Pendidikan*. Bandung: Remaja Rosdakarya.
- Piaget, J. (1952). *The Origins of Intelligence in Children*. New York: International Universities Press
- Rafiah, H., Sumarni, R., & Dewi, L. (2018). Kompetensi berpikir matematis dalam pembelajaran kontemporer. *Jurnal Pendidikan dan Pembelajaran*, 15(1), 24–33.

- Rizaldy, R., Janattaka, & Oktaviarini, N. (2022). Pengaruh media pembelajaran terhadap minat belajar siswa sekolah dasar. *Jurnal Teknologi Pendidikan*, 7(3), 210–220.
- Setyawan, A., Lestari, R., & Widodo, S. (2019). Gangguan perkembangan kognitif anak usia sekolah dasar. *Jurnal Psikologi Perkembangan*, 8(1), 55–63.
- Siregar, D., Putra, M., & Angga, Y. (2024). Kesulitan siswa dalam memahami konsep matematika di sekolah dasar. *Jurnal Pendidikan Dasar Indonesia*, 12(1), 34–42.
- Suherman, E. (2003). *Strategi Pembelajaran Matematika*. Bandung: UPI Press.
- Tamphu, S., Suyitno, I., Susanto, G., Budiana, N., Salim, M. R., Nurhikmah, & Purnawati, W. (2024). Building bridges to the future of learning: Exploring artificial intelligence research using R-Studio assisted bibliometrics. *Cogent Education*, 11(1). <https://doi.org/10.1080/2331186X.2024.2417623>
- Unaenah, U., Maulida, S., & Rahayu, A. (2022). Analisis kesulitan belajar matematika siswa SD berdasarkan teori Piaget. *Jurnal Pendidikan Dasar*, 4(2), 103–112.
- Wakit, A. (2023). Peran matematika dalam kehidupan modern. *Jurnal Pendidikan Sains dan Humaniora*, 6(1), 90–98.
- Yeni, N. (2015). *Pendekatan Pembelajaran untuk Mengatasi Kesulitan Belajar Matematika pada Siswa Sekolah Dasar*. *Jurnal Pendidikan Dasar*, 6(2), 112–120.
- Yuliawan, M., Sari, D., & Hendra, R. (2024). Pengembangan kemampuan berpikir kritis melalui pembelajaran matematika. *Jurnal Inovasi Pendidikan*, 10(1), 40–50.