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# Metacognitive Analysis of Mathematics Learning Based on Cognitive Theory for Fourth Grade Students at JQ Elementary School

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Abstract

Fractions in elementary school mathematics are still considered difficult by students because the concepts are abstract and require deeper thinking skills. This condition causes students to experience difficulties in understanding the concepts of numerators, denominators, and solving fraction problems. Therefore, a learning approach is needed that can help students understand their own thinking processes so that learning becomes more meaningful and easier to understand. This study aims to analyze metacognitive strategies in learning fractions in mathematics for fourth-grade students at JQ Elementary School. This study used a qualitative approach with data collection techniques through observation, tests, and questionnaires of fourth-grade students at JQ Elementary School. The results showed that the metacognitive approach was able to improve students' understanding of fractions through reflection activities, discussions, and the use of concrete media in the form of pizza boards. Students became more active, critical, and able to solve mathematical problems in a more focused manner, making learning more effective and meaningful.

Keywords

Metacognitive; Fractions; Mathematics Learning; Critical Thinking; Elementary School.

## INTRODUCTION

Fractions in elementary school mathematics are still considered difficult by students because the concepts are abstract and require deeper thinking skills. Students often struggle to understand the concepts of numerators and denominators, as well as the process of solving fraction problems, because the learning process tends to be teacher-centered and lacks active student engagement (Mytra, 2025). This situation leads to low student understanding of basic fraction concepts and, consequently, low critical thinking skills in mathematics. Therefore, a learning approach is needed that can help students understand their own thinking processes, making learning more meaningful and understandable (Romadhina & Ruja, 2024).

The urgency of this research lies in the importance of implementing learning strategies that can increase student engagement in understanding mathematical concepts more deeply. A metacognitive approach is one such alternative because it trains students to plan, monitor, and evaluate their thinking processes when solving mathematical problems. Through this approach, students are not only required to obtain correct answers but also to understand the thinking steps used in the problem-solving process. Thus, learning mathematics is no longer understood as a process of memorizing formulas, but rather as a reflective thinking process that can improve students' problem-solving abilities.

Several previous studies have shown that metacognitive approaches have a positive influence on mathematics learning. Research conducted by Wicaksono et al. (2025) showed that the implementation of metacognition-based learning significantly improved students' critical thinking skills in several analyzed studies. Another study conducted by Zamzami & Zamzami (2025) showed that metacognitive strategies play an important role in improving elementary school students' mathematical problem-solving abilities. Furthermore, research conducted by Hacker et al. showed that from two studies in which interventions were given to upper elementary school students who showed mathematical difficulties, there were significant improvements in students' calculation accuracy, mathematical reasoning quality, number of rhetorical elements, and total words. With evidence of improved performance in these areas, FACT+R2C2 holds promise for helping these students become proficient independent learners (Hacker et al., 2019). Research conducted by Siagan et al. (2019) showed that learning materials oriented toward problem-based learning met the criteria for effectiveness and improved mathematical problem-solving skills and metacognitive abilities Research by Thurlings et al. (2019) identified six fraction learning profiles, differing in terms of the

extent to which instruction was connectivist or transmissionist, and the extent to which instruction was student-focused or content-focused.

Based on these previous studies, further research on metacognitive strategies in fraction learning requires further study, particularly in elementary school students using concrete media. This study is novel because it integrates a metacognitive approach with the use of pizza boards to help students understand fraction concepts concretely and reflectively. Therefore, this study aims to analyze metacognitive strategies in fraction learning for fourth-grade students at JQ Elementary School and to determine how this approach can improve students' understanding and critical thinking skills in mathematics.

## METHOD

This study used a descriptive qualitative approach aimed to gain a deeper understanding of the application of metacognitive strategies in learning fractions in mathematics for fourth-grade students at JQ Elementary School (Kaharuddin, 2020). This approach was chosen because the research focuses on the learning process, students' thinking activities, and the learning experiences that emerge during the implementation of metacognitive strategies. Qualitative research allows researchers to gain a comprehensive picture of how students understand fraction concepts through reflection and managing their own thinking in mathematics learning.

The study was conducted at JQ Elementary School with 12 fourth-grade students. The study took place on April 6, 7, and 11, 2026, during the mathematics learning process for fractions. The research subjects were chosen because fourth-grade students are beginning to learn fraction concepts, which require more complex thinking skills than previous mathematics materials. Furthermore, students at this level still require concrete media and guidance in understanding abstract concepts, making a metacognitive approach relevant.

Data collection techniques in this study were conducted through observation, tests, and questionnaires (Siti et al., 2025). Observations were used to determine student activities during the learning process, particularly in understanding the material, discussing, and solving fraction problems. Tests were used to determine students' level of understanding of fraction concepts after the metacognitive approach was implemented. Meanwhile, questionnaires were used to determine students' responses to the learning process. During the learning process, the researchers also used concrete media in the form of pizza boards to help students understand the concepts of numerators,

denominators, and comparing fractions in a more concrete and understandable way.

The data obtained were analyzed descriptively through the stages of data reduction, data presentation, and drawing conclusions (Achjar et al., 2023). The analysis was conducted by identifying changes in student understanding, student engagement in learning, and students' abilities in solving mathematical problems related to fractions. The results of the analysis were then interpreted to determine the effectiveness of the metacognitive approach in helping students understand fraction concepts and improving critical thinking skills in elementary school mathematics.

## FINDINGS AND DISCUSSION

### Findings

#### Application of Metacognitive Strategies in Fraction Learning

Metacognitive strategies in fraction mathematics learning are implemented through a learning process that emphasizes students' awareness of their thinking in understanding concepts and solving mathematical problems (Tay et al., 2024). In practice, teachers not only deliver material in a one-way manner but also guide students to understand the thinking patterns used when solving fraction problems. This approach aligns with Flavell's metacognitive theory, which explains that metacognitive abilities include individual awareness of their thinking processes, the ability to monitor the strategies used, and evaluate their own thinking (Ramadhanti & Yanda, 2021). Through this approach, students begin to understand the relationship between the numerator and denominator in a more systematic and reflective manner. The implementation of this strategy is evident through reflection activities, group discussions, and the provision of prompting questions that help students understand the step-by-step steps for solving problems.

In its implementation, the teacher employed a more interactive learning approach through group discussions and the use of concrete media, such as pizza boards, to help students visually understand the concept of fractions (Siregar & Hatika, 2025). According to Piaget's constructivism theory, learning will be more meaningful when students are directly involved in the process of discovering concepts through concrete learning experiences. (Azzahra et al., 2025; Piaget, 1976; Susanto & Wulandari, 2024). The use of pizza boards helped students understand fractions as parts of a whole, making previously abstract concepts easier to grasp. Furthermore, the teacher posed

reflective questions such as "why was that answer chosen?" and "how did you find that result?" to train students to understand their own thinking processes during the lesson. This demonstrates that metacognitive strategies can create more active, student-centered mathematics learning.

However, the application of metacognitive strategies in mathematics learning also demonstrated changes in students' learning patterns during the learning process. Previously passive students began to demonstrate courage in asking questions, discussing, and explaining problem-solving steps in front of the class. According to Vygotsky & Cole (2018) social interaction in learning plays a crucial role in fostering the development of students' thinking skills through scaffolding and peer collaboration (Azis et al., 2025). Research findings indicate that group discussion activities help students more easily understand fractions because they can exchange ideas and correct mistakes together. Thus, the application of metacognitive strategies not only helps students understand the concept of fractions but also increases student engagement and learning activities in elementary school mathematics.

**Improved Students' Understanding and Critical Thinking Skills**

The application of metacognitive strategies has shown a significant increase in students' understanding of fractions. Before the implementation of metacognitive strategies, most students still struggled to grasp the basic concepts of fractions because learning was primarily oriented toward memorizing formulas and problem-solving procedures. After implementing a metacognitive approach, students began to understand fraction concepts through more focused and reflective thinking processes. This aligns with Anderson's opinion that metacognition helps students control their thinking processes, enabling them to understand the material more deeply (Ozturk, 2024). Students began to be able to systematically explain problem-solving steps and understand the rationale for using certain strategies in solving fraction problems.

In addition to improving conceptual understanding, metacognitive strategies also help develop students' critical thinking skills in mathematics learning. According to Septiany et al. (2024) critical thinking is the ability to think reflectively and rationally, used to make decisions or solve problems effectively. During the learning process, students were seen to be more active in asking questions, providing opinions, and evaluating the answers obtained during the discussions. Students no longer simply accepted answers from the teacher but began to try to find the most appropriate solutions themselves. This situation indicates that metacognitive strategies can help

students develop critical thinking skills through reflection and evaluation of the answers obtained during the learning process.

Improved critical thinking skills were also evident in students' courage in providing reasons for their chosen answers and their ability to correct errors during group discussions. According to Dewey (1986) reflective learning theory, the reflective thinking process helps students understand learning experiences more deeply, thus producing more meaningful understanding (Holdo, 2023; Mutmainah et al., 2025; Yurniati et al., 2023). Research findings indicate that the use of concrete media, such as pizza boards, helped students understand fractions through direct experiences related to everyday life. Thus, metacognitive strategies not only improved students' understanding of fraction concepts but also helped develop critical thinking and problem-solving skills in elementary school mathematics.

**Student Activeness and Involvement in Fraction Learning**

The application of metacognitive strategies in mathematics learning on fractions has shown an increase in student activeness and engagement throughout the learning process. Before the implementation of metacognitive strategies, mathematics learning tended to be passive, with students simply listening to teacher explanations and following example problems. This situation made students less confident in asking questions or expressing opinions when they encountered difficulties understanding the material. After the implementation of metacognitive strategies, students began to show changes in their learning activities through more active involvement in discussions, reflections, and problem-solving activities. This aligns with the active learning theory proposed by Bonwell and Eison, which states that student involvement in the learning process can effectively increase understanding and motivation (Yurniati et al., 2023).

In its implementation, students were directly involved in group discussions to complete student worksheets (LKPD) with their peers. Through these activities, students were seen to be more active in asking questions, providing opinions, and helping friends who were having difficulty understanding fractions. According to Vygotsky, social interaction plays a crucial role in fostering the development of students' thinking skills through collaboration and scaffolding (Damanik et al., 2025). Group discussion activities help students build understanding together, making learning more interactive and enjoyable. Furthermore, the use of concrete media, such as pizza boards, makes students more engaged in learning because the concept of fractions can be understood through a tangible visual form that is close to everyday life.

However, increased student engagement is not only evident in their involvement in group discussions but also in their courage in presenting their ideas to the class. Students become accustomed to explaining the steps in solving problems and providing reasons for their chosen answers during the learning process. According to Rogers' humanistic theory, learning that provides space for freedom and active involvement for students will help increase self-confidence and motivation to learn (Damanik et al., 2025). Research findings indicate that metacognitive strategies can create a more open and participatory learning environment, making students feel more comfortable and actively involved in the mathematics learning process. Thus, metacognitive strategies are able to increase students' activeness and involvement in learning fractions in a more optimal and meaningful way.

**Discussion**

**Implementation of Metacognitive Strategies in Fraction Learning**

*Impact of Implementing Metacognitive Strategies in Fraction Learning*

The application of metacognitive strategies in fraction mathematics learning has a significant impact on students' learning process, enabling them to understand concepts more reflectively and systematically. Metacognitive strategies help students become aware of the thought processes used when solving problems, allowing them to focus not only on the final result but also on the stages of problem-solving. In the context of elementary school mathematics learning, this approach helps students understand the relationship between the numerator and denominator through a more focused thinking process. According to Flavell, metacognitive skills enable students to control their own thinking processes through planning, monitoring, and evaluating strategies used during learning (Murni, 2019). Thus, metacognitive strategies can help students develop a deeper and more meaningful understanding of fraction concepts.

In addition to improving conceptual understanding, metacognitive strategies also impact changes in students' learning activities during learning. Students become more active in asking questions, discussing, and providing reasons for their chosen answers when solving fraction problems. The use of concrete media, such as pizza boards, helps create more interactive learning because students can understand the concept of fractions through real, visual experiences that are close to everyday life. According to Piaget, learning that involves concrete experiences will help elementary school students understand abstract concepts more effectively (Susanto & Wulandari, 2024) Research findings show that metacognitive strategies can create more active, enjoyable, and

engaged learning that focuses on student engagement in understanding mathematics material.

*Comparison of Conventional Learning and Metacognitive Strategies*

In conventional mathematics learning, the learning process tends to be one-way, with the teacher as the center of learning. Students primarily receive information and follow the steps provided by the teacher to solve problems without understanding the rationale for using those steps. This situation results in students simply memorizing problem-solving procedures without fully understanding the basic concepts of fractions. According to FFreire (2020) teacher-centered learning leaves students with less room for critical thinking and active independent knowledge construction (Komariyah, 2025). As a result, students often experience difficulties when faced with problems that differ from the examples provided during the lesson.

Meanwhile, in metacognitive-based learning, students are given the opportunity to understand and control their own thinking processes through reflection, discussion, and evaluation of answers. Metacognitive strategies help students become more active in the learning process because they are directly involved in finding solutions to problems independently. The use of concrete media, such as pizza boards, also helps students understand the concept of fractions more visually and contextually. According to Vygotsky, learning that involves social interaction and active thinking activities will help optimally develop students' cognitive abilities (Erbil, 2020).Therefore, metacognitive strategies are considered more effective than conventional learning in improving conceptual understanding and student engagement in mathematics learning about fractions.

**Improving Students' Understanding and Critical Thinking Skills**

*The Impact of Metacognitive Strategies on Students' Understanding and Critical Thinking*

Metacognitive strategies have a significant impact on improving students' understanding of fractions in mathematics. Through these strategies, students become more accustomed to understanding the thought processes used when solving problems, so they not only memorize formulas but also understand the rationale for using problem-solving steps in greater depth. According to Anderson, metacognitive skills help students control and evaluate their own thinking processes, thus making their understanding of the material more focused and meaningful (Rivas et al., 2022) Research findings indicate that students are beginning to be able to re-explain fraction concepts using their own language and are able to demonstrate problem-solving steps more

coherently and systematically.

In addition to improving conceptual understanding, metacognitive strategies also help develop students' critical thinking skills throughout the learning process. Students become more active in asking questions, providing opinions, and evaluating answers obtained during group discussions. According to Ennis, critical thinking is the ability to think reflectively and rationally to make appropriate decisions or solve problems (Septiany et al., 2024) In metacognitive-based learning, students not only receive answers directly from the teacher but are also trained to independently discover and consider various problem-solving strategies. Thus, metacognitive strategies can help students develop critical thinking and problem-solving skills in elementary school mathematics.

*Comparison of Students' Thinking Skills Before and After Metacognitive Strategies*

Before the implementation of metacognitive strategies, mathematics learning tended to be passive because learning focused more on memorizing formulas and problem-solving procedures. Students simply followed the steps given by the teacher without understanding the thought processes used when solving fraction problems. This condition caused students to experience difficulties when faced with problems that differed from the examples provided. Furthermore, students' critical thinking skills were still low because they were less accustomed to evaluating answers or providing reasons for the solution steps used during the learning process.

Conversely, after implementing metacognitive strategies, students began to demonstrate development in more reflective and critical thinking skills. Students became more accustomed to understanding their own thought processes and were able to explain the reasons for using certain strategies in solving fraction problems. Reflection activities and group discussions helped students understand the material more deeply because they could exchange opinions and correct mistakes with their peers. According to Dewey, reflective learning helps students build more meaningful learning experiences and encourages the optimal development of critical thinking skills (Holdo, 2023), Therefore, metacognitive strategies are considered more effective than conventional learning in improving elementary school students' understanding and critical thinking skills.

**Student Activeness and Engagement in Fraction Learning**

*The Impact of Metacognitive Strategies on Student Activeness and Engagement*

The application of metacognitive strategies has a positive impact on increasing student activeness and engagement during the mathematics learning process of fractions. Metacognitive

strategies help students become more confident in asking questions, expressing opinions, and actively participating in group discussions when solving fraction problems. According to Bonwell and Eison, active learning can increase student engagement in the learning process, thereby optimizing understanding of the material (Putri et al., 2025). In metacognitive-based learning, students not only listen to the teacher's explanation but are also directly involved in reflection and problem-solving activities, making learning more interactive and participatory.

In addition to increasing student activeness, metacognitive strategies also help create a more enjoyable and meaningful learning environment. The use of concrete media, such as pizza boards, makes students more interested in participating in the learning process because the concept of fractions can be understood through a visual form that is tangible and relevant to everyday life. According to Piaget's constructivist theory, concrete learning experiences play a crucial role in helping elementary school students understand abstract concepts more effectively (Susanto & Wulandari, 2024) Research findings indicate that students appear more enthusiastic, actively participate in discussions, and confidently express their thoughts during learning. Thus, metacognitive strategies can create more active mathematics learning that centers on student engagement.

*Comparison of Student Engagement in Conventional and Metacognitive Learning*

In conventional mathematics learning, students tend to be less actively involved in the learning process because it is one-way and teacher-centered. Students focus more on listening to teacher explanations and working on examples without any discussion or reflection on their answers. This situation makes students easily bored and less willing to express their opinions when they encounter difficulties understanding the material. Furthermore, the lack of use of concrete learning media makes the concept of fractions difficult for elementary school students to grasp.

In contrast to conventional learning, metacognitive strategies provide more space for students to actively engage in the learning process. Students are involved in group discussions, reflections, and answer evaluations, making learning more interactive and collaborative. The use of pizza boards also helps students understand fractions in a more contextual and enjoyable way. According to Vygotsky, social interaction in learning plays a crucial role in fostering the development of students' thinking skills through collaboration and the exchange of ideas among peers (Azis et al., 2025; Shabani et al., 2010) Therefore, metacognitive strategies are considered more effective than conventional learning in increasing student engagement and activity in learning

fractions in mathematics.

## CONCLUSION

Based on the above description, it can be concluded that: 1) the application of metacognitive strategies in learning fractions in mathematics for fourth-grade students at JQ Elementary School helps students understand their own thinking processes through planning, monitoring, and evaluating problem-solving steps. This ensures that learning is not only oriented toward the final result but also toward a systematic and reflective thinking process; 2) metacognitive strategies can improve students' understanding of fraction concepts and critical thinking skills through reflection activities, group discussions, and the use of concrete media, such as pizza boards, which help students understand fraction concepts visually, contextually, and more easily understood in everyday life; 3) the application of metacognitive strategies also increases student engagement and involvement in mathematics learning, enabling them to be more active in asking questions, expressing opinions, working collaboratively in groups, and gaining confidence in explaining problem-solving steps during the learning process.

This research provides a theoretical contribution by enriching the study of metacognitive strategies in elementary school mathematics learning, particularly in fractions, which students have traditionally found difficult due to their abstract nature. Meanwhile, practically, this research can serve as a reference for teachers in developing more active, reflective, and student-centered mathematics learning through the application of metacognitive strategies and the use of concrete media in the learning process. The findings also demonstrate that learning that engages students' thinking awareness can create a more interactive, enjoyable, and meaningful learning environment, in line with the needs of 21st-century learning.

The limitations of this research lie in its scope, which was conducted in only one class and focused on fractions. Therefore, the results cannot be broadly generalized to all mathematics lessons in elementary schools. Furthermore, this study used a qualitative approach, thus failing to measure improvements in student learning outcomes quantitatively and in depth. Therefore, future research is expected to employ a broader research approach involving more subjects, different learning materials, and using quantitative and mixed methods to achieve more comprehensive and applicable results in improving the quality of mathematics learning in elementary schools.

**REFERENCES**


Achjar, K. A. H., Rusliyadi, M., Zaenurrosyid, A., Rumata, N. A., Nirwana, I., & Abadi, A. (2023). *Metode penelitian kualitatif: Panduan praktis untuk analisis data kualitatif dan studi kasus*. PT. Sonpedia Publishing Indonesia.

Azis, A., Hilmy, M., & Erawati, D. (2025). Integrasi Media dalam Pembelajaran: Pendekatan Konstruktivisme Vygotsky: Media Integration in Learning: Vygotsky's Constructivism Approach. *Anterior Jurnal*, *24*(3), 1–7.

Azzahra, N. T., Ali, S. N. L., & Bakar, M. Y. A. (2025). Teori konstruktivisme dalam dunia pembelajaran. *Jurnal Ilmiah Research Student*, *2*(2), 64–75.

Damanik, N., Malau, O. L., Sinaga, S., Siburian, R. D., & Simanjutak, T. (2025). Implementasi pendekatan Zone of Proximal Development (ZPD) dalam mengatasi kesulitan pada materi struktur aljabar. *As-Salam: Journal Islamic Social Sciences and Humanities*, *3*(1), 55–64.

Dewey, J. (1986). Experience and education. *The Educational Forum*, *50*(3), 241–252.

Erbil, D. G. (2020). A review of flipped classroom and cooperative learning method within the context of Vygotsky theory. *Frontiers in Psychology*, *11*, 1157.

Freire, P. (2020). Pedagogy of the oppressed. In *Toward a sociology of education* (pp. 374–386). Routledge.

Hacker, D. J., Kiuhara, S. A., & Levin, J. R. (2019). A metacognitive intervention for teaching fractions to students with or at-risk for learning disabilities in mathematics. *ZDM*, *51*(4), 601–612.

Holdo, M. (2023). Critical reflection: John Dewey's relational view of transformative learning. *Journal of Transformative Education*, *21*(1), 9–25.

Kaharuddin, K. (2020). Kualitatif: ciri dan karakter sebagai metodologi. *Equilibrium: Jurnal Pendidikan*, *9*(1), 1–8.

Komariyah, S. (2025). The Relevance of Paulo Freire's Dialogical Concept in Enhancing Mathematical Understanding in Islamic Elementary Schools: Relevansi Konsep Dialog Paulo Freire dalam Meningkatkan Pemahaman Matematika di Madrasah Ibtidaiyah. *NUMBERS: Jurnal Pendidikan Matematika & Ilmu Pengetahuan Alam*, *3*(1), 10–20.

Murni, A. (2019). Metakognisi dalam pembelajaran matematika. *Jurnal Prinsip Pendidikan Matematika*, *1*(2), 1–14.

Mutmainah, R., Supriyatno, T., & Susilawati, S. (2025). Konstruksi dan Desain Kurikulum Berbasis Pendekatan Experiential Learning John Dewey dalam Konteks Pendidikan Islam di Sekolah dan Perguruan Tinggi. *MUKADIMAH: Jurnal Pendidikan, Sejarah, Dan Ilmu-Ilmu Sosial*, *9*(2), 572–582.

Mytra, P. (2025). Students' Difficulties in Understanding Fraction Concepts in Mathematics at Elementary School. *EduTransform: Multidisciplinary International Journal*, *1*(2), 32–38.

Ozturk, N. (2024). Revisiting Flavell's Theory of Metacognition for Metacognitive Responsiveness. *Journal of Theoretical Educational Sciences*, *17*(2), 257–271.

Piaget, J. (1976). *Piaget's theory*. Springer.

Putri, R., Hidayah, M., & Gusmaneli, G. (2025). Implementasi Model Pembelajaran Aktif Berbasis Kolaboratif untuk Meningkatkan Pemahaman Konseptual Siswa. *Jurnal Manajemen Dan Pendidikan Agama Islam*, *3*(6), 25–34.

Ramadhanti, D., & Yanda, D. P. (2021). Students' Metacognitive Awareness and Its Impact on Writing Skill. *International Journal of Language Education*, *5*(3), 193–206.

Rivas, S. F., Saiz, C., & Ossa, C. (2022). Metacognitive strategies and development of critical thinking in higher education. *Frontiers in Psychology*, *13*, 913219.

Romadhina, L., & Ruja, I. N. (2024). Telaah Teori Kecerdasan Majemuk Howard Gardner: Relevansi dan Implikasinya Terhadap Pembelajaran Ilmu Pengetahuan Sosial. *Jurnal Integrasi Dan Harmoni*

*Inovatif Ilmu-Ilmu Sosial*, *4*(8), 7.

Septiany, L. D., Puspitawati, R. P., Susantini, E., Budiyanto, M., Purnomo, T., & Hariyono, E. (2024). Analysis of high school students' critical thinking skills profile according to Ennis indicators. *IJORER: International Journal of Recent Educational Research*, *5*(1), 157–167.

Shabani, K., Khatib, M., & Ebadi, S. (2010). Vygotsky's zone of proximal development: Instructional implications and teachers' professional development. *English Language Teaching*, *3*(4), 237–248.

Siagan, M. V, Saragih, S., & Sinaga, B. (2019). Development of Learning Materials Oriented on Problem-Based Learning Model to Improve Students' Mathematical Problem Solving Ability and Metacognition Ability. *International Electronic Journal of Mathematics Education*, *14*(2), 331–340.

Siregar, P. S., & Hatika, R. G. (2025). *Menciptakan Pembelajaran Menyenangkan Di Sekolah Dasar*. Deepublish.

Siti, R., Silvia, J., & Ahmad, G. (2025). Teknik pengumpulan data: Observasi, wawancara dan kuesioner. *Vol*, *3*, 39–47.

Susanto, A. H., & Wulandari, M. D. (2024). Optimalisasi Pembelajaran Anak Usia Sekolah Dasar Melalui Pemahaman Teori Perkembangan Kognitif Jean Piaget. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, *9*(04), 689–706.

Tay, L. Y., Chan, M., Chong, S. K., Tan, J. Y., & Aiyoob, T. B. (2024). Learning of mathematics: A metacognitive experiences perspective. *International Journal of Science and Mathematics Education*, *22*(3), 561–583.

Thurlings, M., Koopman, M., Den Brok, P., & Pepin, B. (2019). Portraying Primary Fraction Teaching: A Variety of Mathematical Richness, Pedagogic Strategies, and Use of Curriculum Materials. *International Journal of Education in Mathematics, Science and Technology*, *7*(2), 170–185.

Vygotsky, L., & Cole, M. (2018). Lev Vygotsky: Learning and social constructivism. *Learning Theories for Early Years Practice. UK: SAGE Publications Inc*, 68–73.

Wicaksono, S. T. B., Dewi, R. S. I., Ekawati, R., & Nugraha, J. (2025). Inovasi Pembelajaran Pecahan Berbasis Metakognisi Untuk Meningkatkan Berpikir Kritis di Sekolah Dasar. *Jurnal Pena Edukasi*, *12*(1), 21–32.

Yurniati, Y., Perimasanti, R. D. A., & Syafitri, L. N. H. (2023). Pembelajaran Berbasis Pengalaman Sebagai Inti Teori Konstrukturvisme John Dewey Dalam Perspektif Psikologi Pendidikan. *Nuansa Akademik: Jurnal Pembangunan Masyarakat*, *8*(2), 635–642.

Zamzami, M. A., & Zamzami, M. R. A. (2025). Peran Strategi Metakognitif dalam Meningkatkan Pemahaman Materi Pembelajaran pada Siswa Sekolah Dasar. *Primary Education Journals (Jurnal Ke-SD-An)*, *5*(1), 415–421.