Journal of Research in Instructional
e-ISSN: 2776-222X
Vol. 5(2) 2025, pp. 462 – 475
https://doi.org/10.30862/jri.v5i2.692

Implementation of jigsaw learning to improve mathematics learning outcomes of grade IV elementary school

Diah Rizki Nur Kalifah[1,*], Ali Nasrullah[2], Badlihisham Mohd Nasir[3], Zingiswa Mybert Monica Jojo[4]

[1]Universitas Islam Negeri Raden Intan Lampung, Indonesia
[2]Universitas Terbuka, Indonesia
[3]Universiti Teknologi Malaysia, Malaysia
[4]Rhodes University, South Africa

Submitted: 12-04-2025

Accepted: 15-05-2025

Published: 17-05-2025

Abstract: The low learning outcomes of mathematics at the primary school level, especially among fourth-grade students, are a major concern in the world of education. Despite numerous efforts to enhance the comprehension of mathematical concepts, the outcomes remain unsatisfactory. The purpose of the study was to explore the application of the jigsaw model in improving mathematics learning outcomes in grade IV. The type of research is classroom action research (CAR), with a Kemmis and Taggart model design, consisting of two cycles. Each cycle includes four stages: planning, implementation, observation, and reflection. The research subjects were 12 fourth-grade students, and data collection techniques were conducted through observation, tests, and documentation. Data analysis was conducted using the descriptive analysis method, using descriptive statistical formulas such as frequency distribution and average. The findings showed that the application of the jigsaw model succeeded in improving the learning outcomes of fourth-grade students, as evidenced by the percentages of 43% in cycle I and 89% in cycle II. Therefore, we conclude that the application of this model effectively enhances students' mathematics learning outcomes. Future research can explore the specific factors in the application of the jigsaw model that have the most influence on improving learning outcomes.

Keywords: Jigsaw model, learning outcomes, mathematics

Abstrak: Rendahnya hasil belajar matematika pada jenjang sekolah dasar, khususnya siswa kelas IV, menjadi perhatian utama dalam dunia pendidikan. Meskipun telah banyak upaya dilakukan untuk meningkatkan pemahaman konsep matematika, namun hasil yang diperoleh masih belum memuaskan. Tujuan penelitian ini adalah untuk mengetahui penerapan model jigsaw dalam meningkatkan hasil belajar matematika siswa kelas IV. Jenis penelitian yang digunakan adalah penelitian tindakan kelas (PTK) dengan desain model Kemmis dan Taggart yang terdiri dari dua siklus. Setiap siklus meliputi empat tahap, yaitu perencanaan, pelaksanaan, observasi, dan refleksi. Subjek penelitian adalah siswa kelas IV yang berjumlah 12 orang. Teknik pengumpulan data dilakukan melalui observasi, tes, dan dokumentasi. Analisis data dilakukan dengan metode analisis deskriptif, yaitu dengan menggunakan rumus statistik deskriptif seperti distribusi frekuensi dan rata-rata. Hasil penelitian menunjukkan bahwa penerapan model jigsaw berhasil meningkatkan hasil belajar matematika siswa kelas IV, yang dibuktikan dengan persentase 43% pada siklus I dan 89% pada siklus II. Dengan demikian, dapat disimpulkan bahwa penerapan model ini efektif meningkatkan hasil belajar matematika siswa. Penelitian di masa mendatang dapat mengeksplorasi faktor-faktor spesifik dalam penerapan model jigsaw yang memiliki pengaruh paling besar terhadap peningkatan hasil belajar.

Kata kunci: Model jigsaw, hasil belajar, matematika

*Corresponding author: dnurkalifah@gmail.com

INTRODUCTION

The educational process in schools includes the learning process. In carrying out educational tasks in schools, teachers have a primary role in implementing and presenting

an effective and efficient learning program (Nugraha et al., 2025). According to Arum et al. (2023) learning activities are the most fundamental part of the educational process in schools. Learning is the manifestation or development of a person's potential abilities or talents (Nasir et al., 2024; Syauqi et al., 2024). Nawawi et al. (2023) said that learning is not to change a person's behavior but to change the school curriculum in such a way that students can learn more and more easily. Many elementary school students consider mathematics as the most difficult and complicated learning (Hartatik et al., 2024). In learning mathematics, problem solving is required, so mathematics is considered difficult and feared by many students (Sintia et al., 2024).

In research by Puspita et al. (2018), they found that most students study mathematics as if it is just a perfunctory activity, and they do not think about getting the best grades. In grade 4 students of SDN Tegalrejo 1, not all students reached the minimum completeness criteria ≥ 70. From the observation results involving 16 students, only 5 students, or 31.25%, scored above the minimum completeness criteria, while 11 students, or 68.75%, did not meet the minimum completion criteria and also tended to be passive. In research Andeswari et al. (2022), mathematics is often seen as a challenging subject, and it is the most disliked, even hated, by many elementary school students. They express frustration, stating that math is hard for them to grasp and visualize due to its use of abstract numbers.

In addition, Nurhasanah et al. (2022) proposed that the challenges encountered by students during mathematics instruction encompass: (1) a tendency for students to be passive and more reserved throughout the educational experience, (2) the absence of learning motivation owned by students and most students learn out of compulsion, (3) Students do not realise the essence of a concept they learn and only rely on memorising, and (4) the response of students is very low during learning activities, especially mathematics learning activities. However, the urgency of mathematics lessons requires students to comprehend mathematical concepts, patterns and skills because almost all fields of study require proper mathematics. Thus, students need to be able to grasp mathematical learning because mathematics is a means to solve everyday problems.

Mathematical problem solving is a procedure of solving problems that are faced with mathematical concepts, patterns and skills (Olivares et al., 2021; Ukobizaba et al., 2021). Many students in grade IV feel that maths is a difficult and uninteresting subject. This causes them to participate less actively in learning and tend to avoid tasks related to maths. Students often experience difficulties in understanding basic maths concepts, such as addition and subtraction. According to previous research, these learning difficulties can be resulting from a deficiency in understanding of the basic concepts needed to solve more complex maths problems. The use of monotonous and less varied learning methods is also one of the factors contributing to low learning outcomes in mathematics. Students in grade IV often do not get a fun and interactive learning experience that can increase their interest and understanding of mathematics.

Based on research by Yolanita and Ruswendi (2024), mathematics learning, especially in elementary schools is still relatively low. Mathematics itself is a science related to abstract concepts (Rahmaini & Chandra, 2024). According to Mega and Madani (2023), mathematics is implemented separately, because learning mathematics is very difficult to be associated with other subjects. Mathematics is a science that is arranged systematically that the concepts studied are related to one another (Krisnadi, 2022). Mathematics learning

is learning that is organised systematically and precisely so that it can be used as a tool to solve various problems in everyday life (Margayanti et al., 2024). Mathematics is a difficult and boring learning, so many students are less interested and even make mathematics one of the lessons to be avoided.

Students who lack interest in learning mathematics often struggle to understand the material presented, which negatively affects their learning outcomes. Observations in mathematics classes reveal that many students score below the minimum completion criteria of 70. Specifically, only 3 students (35%) meet this criterion, while 8 students (65%) do not. The low learning outcomes in grade IV indicate that during the learning process, many students engage in chatting and pay little attention when the teacher explains. Additionally, students show a lack of responsibility for the tasks assigned by the teacher, resulting in poor performance in mathematics. This situation highlights a significant lack of interest in learning mathematics among the students.

Sarumaha (2023) stated that students who have an interest in the lesson, are more active in studying in detail and trying to solve mathematical problems so that students understand the material better and get maximum results. To overcome low student learning outcomes in mathematics, teachers need innovation in learning models that can foster student interest in mathematics lessons so that learning outcomes increase. Jigsaw learning is one of these learning approaches. The jigsaw learning, according to Rahmi et al. (2024), is a learning model built on the shape of a multipurpose learning group structure that can be applied to all subjects and at all levels to foster group knowledge and skills. The jigsaw learning paradigm has the capacity to enhance individual talents in addition to group expertise and skills (Alfirdaus et al., 2025; Thenu et al., 2023).

The jigsaw learning approach fosters a more active learning process, enabling students to independently or collaboratively explain teacher-presented material to their group members, thereby enhancing their understanding of the topic. Building upon this foundation of collaborative learning, Jusriani and Muchlis (2023) highlight the jigsaw learning as a tool for students to enhance learning activities and achieve better learning outcomes, emphasizing student interaction in completing tasks to achieve teaching and learning objectives. The purpose of jigsaw learning is to present alternative models besides lectures and reading, examine positive interdependence in conveying and receiving information among group members to encourage maturity of thinking, and provide opportunities to practice speaking and listening for student cognition in conveying information (Dusalan & Sowanto, 2023).

Jigsaw learning has stages in learning, namely the cooperative stage; at this stage students are placed in small groups consisting of 5 students or more (Juliarti, 2022). This group is called a cooperative group and receives some information or reading from one information package which is immediately discussed/solved in the cooperative group, expert stage; as members who receive certain tasks, students receive the same task, namely studying together and becoming experts in the field of information (reading), solving how to teach information (reading content) that has been mastered into the cooperative group and the five-a-side stage; at this stage the expert group students return to their cooperative group (original group). There is previous research related to the jigsaw learning, such as research Raditya et al. (2023) which states that there is a positive influence of this learning model.

Students in grade V elementary school are using cooperative jigsaw with the help of PowerPoint presentations to improve their teamwork and scientific learning objectives. According to research by Asda (2022), the jigsaw learning can enhance student learning outcomes, boost teacher and student engagement, and receive positive feedback from students. Then, according to the study by Amalia et al. (2023), learning results for students as well as activities for teachers increased. The study Wijayanto (2022) revealed that there was an improvement in student learning outcomes both individually and classically in Pancasila and citizenship education learning. The average values for cycles I and II show that jigsaw learning activities can enhance the learning outcomes of fifth-grade elementary school children (66.67 and 81.39, respectively).

Based on several studies, the difference with the one studied lies in the subjects and subjects used. Previous studies used grade V students and science and Pancasila and Citizenship Education subjects, while this study used grade IV students with mathematics subjects. As previously explained, the study's goal was to ascertain whether using the jigsaw learning in mathematics classes in grade IV elementary schools improved student learning results.

METHOD

This study employs a classroom action research (CAR). The purpose of this classroom action research project was to enhance the standard of instruction and provide teachers with the tools they need to address issues in the classroom (Adiani et al., 2023; Widyaningsih et al., 2019). The location of this research was conducted at SDN 1 Sumberejo, the rationale for selecting this research location is that there are still numerous students whose learning outcomes remain below the minimum completion criteria, particularly in mathematics for grade IV. The participants in this study were 12 students from class IV of elementary school S, comprising 7 boys and 5 girls. Data collection techniques included tests, observations, and documentation, aimed at obtaining comprehensive and valid data.

The next stage of observation carried out is filling out the observation sheet, the researcher documented the findings of the observations carried out during the learning process. to directly find out the actions that occurred during the observation and the learning process carried out by students. Findings from observations carried out throughout the learning process indicate that there are still some students who pay less attention to what they are learning, students still have difficulty understanding what is being learned, and some groups have difficulty completing assignments on time and correctly. When conducting research, a research design or design is needed to facilitate researchers when conducting research. The research design adopts from Kemmis and Taggart with two cycles and each cycle includes four stages consisting of planning, implementation, observation and reflection (Mardiana & Suharyanto, 2024). The research design is shown in Figure 1.

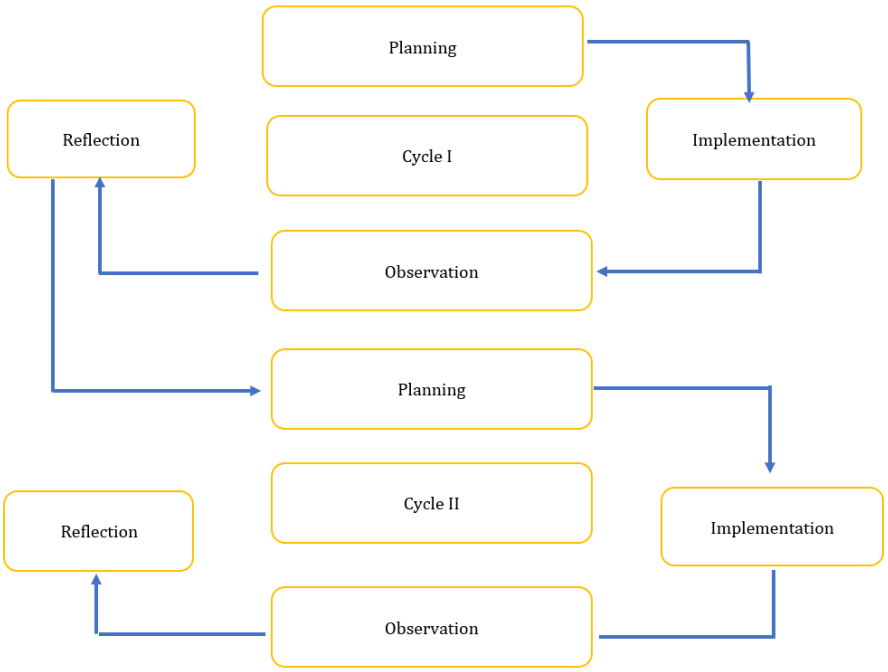

Fig. 1. The research design

The standard minimum completeness criteria for mathematics subjects in class IV is 70 to be declared complete. The standard of classical completeness set is 80%. If in a class there are 12 students and 10 students (80%) have reached the minimum completeness criteria, then the learning is considered to have been classically successful. Technique used is the descriptive analysis method. In order to interpret data and draw a general conclusion, the descriptive analysis approach uses descriptive statistical formulas like frequency distribution and average values (mean) to characterize the state of a certain object (Sriyanti & Putri, 2023). Regarding the examination of quantitative data procedures in the form of numerically presented data, the percentage analysis is employed. Formula Which used For count average class is:

$$\text{Avreage} \frac{\text{Sum mark test all over students}}{\text{Total number of students}} \quad (1)$$

Table 1. Categories based on the percentage of classical completeness

Criteria	Percentage
Very High	90-100
High	80-89
Moderate	70-79
Low	70-69

Whereas completeness study classical counted with use:

$$\text{Completeness study classical} \frac{\text{Total students who pass}}{\text{Amount all students}} \text{x } 100\ \% \quad (2)$$

RESULTS AND DISCUSSION

Cycle I

In the planning phase of cycle I, the primary focus is on creating a lesson plan, along with preparing instruments, evaluation sheets, and observation sheets. Following this, observations are conducted regarding school conditions, classroom conditions, students' situations, facilities, and infrastructure that facilitate learning, as well as the jigsaw learning model employed in the implementation of fourth-grade mathematics instruction.

In the implementation stage, students begin by reading and checking math books as part of the beginning of learning. Then the teacher gives directions and explains what will be done next, the teacher instructs students to form groups, then the teacher provides explanations and instructions to the group about what to do. All students come together to summarize the resources supplied by the teacher. The teacher administers questions with multiple choices that pertain to the subject matter, and the information learned is used to assess learning outcomes. The jigsaw learning model is applicated in groups to promote student participation and enthusiasm in the learning procedure as well as teamwork.

Among the twelve students, only six students were able to respond to the questions correctly. While of all the students, only five students got high test scores from the minimum required score (above minimum completion criteria). Due to the fact that the jigsaw learning was implemented for the first time, the observation data indicates that student learning outcomes have improved; however, the increase is still small. Results of the implementation of cycle 1 regarding the application of model jigsaw for increase results Study student on load lesson mathematics in Table 2.

Table 2. Data descriptive frequency mark test results study student in cycle I

Success Rate %	Category	Number of Students	%
90-100	Very High	3	18
80-89	High	5	43
70-79	Moderate	4	39
70-69	Low	-	0

The results of the learning test for grade IV students in cycle I showed that 3 students were categorized as very high with a success rate of 18%, there were 5 students categorized as high with a success rate of 43%, there were 4 students categorized as moderate with a success rate of 39% and no students in the low categories. Meanwhile, in Table 3 for the percentage of completion of the application of the jigsaw learning in increase results study student on load lesson mathematics.

Table 3. Description completeness learning outcomes students in cycle I

Individual Values	Classical %	Category	Number of Students	%
70-100	80-100	Completed	5	43
0-69	0-79	Not Completed	7	57
	Amount		12	100

Among the 12 students, 5 finished the task, representing 43%, while 7 did not complete it, accounting for 57%. After the actions and observations were carried out, the next step was reflection. Reflection was carried out to determine the difficulties and shortcomings encountered throughout the activities of cycle I. Observation findings showed that the jigsaw cooperative learning model had not been implemented as well as possible in mathematics learning cycle I. One of the shortcomings noted was that of the twelve students who found it difficult to complete individual and group assignments, seven students scored below 70. For overcome problem on cycle I need held repair on cycle II, the source need improvement because the research targets and objectives for each learning indicator have not been achieved.

Although the jigsaw learning can improve learning outcomes, its implementation is not optimal. Many students have difficulty understanding the material, from the low level of task completion. This was caused by students' lack of attention, difficulty in group work, and lack of understanding of mathematical concepts. Therefore, cycle II was designed with some key improvements. The explanation of mathematical concepts would be enhanced with real-world examples and explicit modelling of the jigsaw process. Task instructions would be clarified and each student would have a specific role in the group to increase accountability and collaboration. Scaffolding activities and differentiated tasks will be provided to meet the diverse learning needs of students. Monitoring and feedback will be improved to ensure student engagement and understanding. With these improvements, it is expected that cycle II can overcome the shortcomings of cycle I and increase the effectiveness of the jigsaw model in improving students' mathematics learning outcomes.

Cycle II

In cycle II planning stage, the teacher introduces the topic to be discussed, including fraction identification and asks questions about the position of fractions on the number line according to the schedule in the lesson plan. During the implementation of cycle II meeting 2, the researcher began with several preparatory exercises such as explaining the learning objectives to be achieved and providing information about the subjects to be studied, namely the introduction of fractions and their sequences. During the learning process, the teacher helps students simplify fractions and asks representatives from each group to provide the results of their group's efforts.

In general, the implementation of cycle II has increased compared to observations in cycle I. This can be seen from observations that show that teachers have effectively communicated the learning objectives to be achieved, more effectively with study groups compared to cycle I where students were able to manage their time and almost all students achieved good learning outcomes. Table 4 shows students' grades in cycle II.

Table 4. Data descriptive frequency mark test results study student on cycle II

Success Rate %	Category	Number of Students	%
90-100	Very High	4	36
80-89	High	6	54
70-79	Moderate	2	11
70-69	Low	-	0

There are 4 students categorized as very high with a success rate of 36%, there are 6 students categorized as high with a success rate of 54%, there are 2 students categorized as moderate with a success rate of 11%, and no students in low categories. Meanwhile, Table 4 is the percentage of completion of improving learning outcomes in mathematics learning content through the cooperative learning type model in cycle II.

Table 5. Description completeness results study students in cycle II

Individual Values	Classical %	Category	Number of Students	%
70-100	80%-100%	Completed	10	89
0-69	0%-79%	Not Completed	2	11
	Amount		12	100

In the completion of mathematics learning outcomes, there were 10 students who completed it with a percentage of 89% and there were 2 students who did not complete it with a percentage of 11%. In the reflection stage in cycle II, the mathematics learning procedure with the jigsaw learning can be effective increase yield study students. So in this study it is enough to reach cycle II because of the 12 students, more than half have completed their learning outcomes after the application of the jigsaw learning. Figure 2 is a bar chart comparing pre-cycle, cycle one and cycle two.

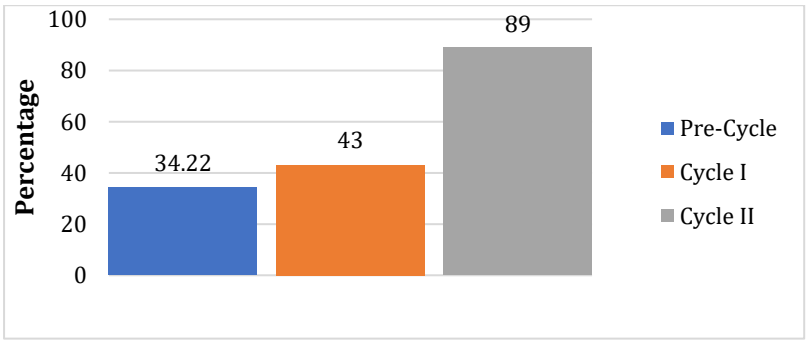

Fig 2. Comparison of students' mathematics learning outcomes

The learning outcomes of students in mathematics during cycle I are categorized as satisfactory, and the use of the jigsaw type cooperative learning model in their learning activities has not shown improvement. Due to their inability to follow the teacher's instructions and their lack of knowledge about how to use the cooperative model learning type jigsaw, students' learning results are still comparatively low. Considering the results of student learning in cycle I, which did not meet the minimum completion criteria, cycle II will be conducted as a follow-up to cycle I.

The next action taken aims to improve student learning outcomes that have not been achieved during the learning activities. Students pay more attention to the teacher's explanations in cycle II as she goes into further depth about how the jigsaw learning is being implemented. Cycle II was deemed successful when the instructor was able to implement the jigsaw learning in class IV elementary school 1 Sumberejo, and the results were better than those of cycle I. According to the findings of the cycle II test, which showed an increase from the cycle I test, where the average student score was 58.4 to 87.3, this can be

demonstrated by the fact that the learning outcomes of the students were characterized as good.

Utami (2022) stated that the use of the jigsaw learning had a real impact in providing contribution in improving students' learning outcomes and conceptual understanding so that they are able to reduce there is a lack of understanding of the material given. Andriyati and Noviani (2023) also argue that the collaboration of using learning models is very useful in encouraging student learning achievement and is able to foster the ability to find and solve problems given. On the side other Kurniawan et al. (2021), and Wang et al. (2023) explained that the application of the jigsaw type learning is able to increase the effectiveness of student learning in class and is also able to build skills and scientific insight.

Elementary school mathematics learning materials consist of various concepts that can be applied in solving everyday problems. The application of jigsaw cooperative learning provides students with the opportunity to be actively involved in discussions with their groups to discuss newly learned concepts and solve problems. The jigsaw learning is able to empower students to be active in learning both individually and in groups (Nnamani et al., 2023; Silva et al., 2023). This model is able to increase students' enthusiasm to be active in learning in groups, so that it will create high interest and motivation in learning both individually and in groups. The jigsaw learning by actively involving students in mathematics teaching and learning activities will create enjoyable learning (Resmi, 2022; Suhartini & Buhaerah, 2022; Yudha et al., 2021).

Through group learning, students are able to learn to be more creative in solving problems collaboratively in achieving goals. The jigsaw cooperative learning model provides students with the opportunity to solve problems with other groups, making learning more meaningful (Møgelvang & Nyléhn, 2023; Yimer, 2022). Meaningful learning can make understanding the material easier (Hasibuan et al., 2022; Siregar et al., 2025; Winarno et al., 2025; Wowor et al., 2022). Learning by implementing the jigsaw cooperative learning model can be used to train social skills through group learning (Rahayu et al., 2024; Setiawan et al., 2024; Suriyanisa et al., 2024). Through group learning, students' sense of responsibility can be increased (Setyawan & Prabawa, 2023; Zativalen et al., 2022). Students are required to be ready to present the material. So that the material obtained is not only from the teacher. So that students have responsibility for themselves and their groups.

This finding is backed by the findings of previous research, namely research Syaputri et al. (2024) explaining that there is an improvement in students' cognitive learning outcomes and learning effectiveness students in the application of the jigsaw which can encourage problem solving skills. given from cycle I to the next cycle. Furthermore, Pasinggi, (2023) it suggests that the application of the jigsaw learning can improve student learning outcomes. Kurnia (2023) asserts that applying jigsaw learning can boost learning motivation. Then, the study of Arta (2021) uses the jigsaw learning to improve learning outcomes.

Additionally, Leniati and Indarini (2021) study found that the jigsaw learning approach influences critical thinking of elementary school students abilities while they study mathematics. Furthermore, according to research by Mahfutri and Fahyuni (2023) using the jigsaw model might boost students' enthusiasm to learn because they feel accountable for their group and actively participating in the process. Students are more

engaged and comprehend the mathematical concepts taught as a result, which improves learning results in mathematics. According to a number of earlier studies, student learning outcomes can be enhanced by using the jigsaw learning paradigm.

CONCLUSION

This research shows that applying the jigsaw learning model significantly improved student learning outcomes in mathematics. The rise in the percentage of students meeting completion criteria (from 43% in Cycle I to 89% in Cycle II) and the notable increase in average student scores (from 58.4 to 87.3) validate this positive effect. Thus, the research goal of enhancing student learning outcomes in mathematics using the jigsaw model was successfully met. While acknowledging limitations such as subject size, external variables, and study duration, the findings suggest that collaborative learning methods can significantly contribute to a more dynamic and engaging learning environment, fostering improved understanding of mathematical concepts.

REFERENCES

Adiani, P., Diniyah, L., Yulistia, N., Kirana, R. F., & Nuraeni, R. (2023). Pentingnya Kolaborasi Guru dalam Penelitian Tindakan Kelas. *Jurnal Kreativitas Mahasiswa*, *1*(1), 85–91. https://riset-iaid.net/index.php/jpm/article/view/1444

Alfirdaus, J. M., El Yunusi, M. Y. M., & Sulaiman, S. (2025). Implementasi Model Pembelajaran Kooperative Tipe Jigsaw dalam Meningkatkan Kreativitas Belajar Siswa Pada Mata Pelajaran Fiqih di SMA Islam Parlaungan Waru Sidoarjo. *Jurnal Al-Fatih*, *8*(1), 14–37. https://doi.org/10.61082/alfatih.v8i1.430

Amalia, S. N., Amrah, A., & Hotimah, H. (2023). Penerapan Model Pembelajaran Kooperatif Tipe Jigsaw Untuk Meningkatkan Hasil Belajar Siswa Kelas V SD. *Nubin Smart Journal*, *3*(1), 12–21. https://ojs.nubinsmart.id/index.php/nsj/article/view/154

Andriyati, R., & Noviani, L. (2023). Kolaborasi model PBL dan model STAD dalam pembelajaran ekonomi. *Jurnal Pendidikan Ekonomi (JUPE)*, *11*(2), 92–102. https://doi.org/10.26740/jupe.v11n2.p92-102

Arta, I. M. (2021). Penerapan model pembelajaran kooperatif tipe jigsaw untuk meningkatkan hasil belajar IPS siswa kelas V SD Negeri 4 Tenganan semester II Tahun Pelajaran 2018/2019. *Action: Jurnal Inovasi Penelitian Tindakan Kelas Dan Sekolah*, *1*(1), 9–21. https://doi.org/10.51878/action.v1i1.283

Arum, D. S., Nurhasanah, A. D. P., & Hajron, K. H. (2023). Penerapan Model Pembelajaran Students Teams Achievement Division (STAD) Untuk Meningkatkan Hasil Belajar Pada Mata Pelajaran Bahasa Indonesia Kelas Rendah. *Prosiding Seminar Nasional Ilmu Pendidikan*, *2*(1). http://e-jurnal.fkip.unila.ac.id/index.php/psnip/article/view/287

Asda, Y. (2022). Efektivitas Pembelajaran Model Kooperatif Tipe Jigsaw Untuk Meningkatkan Hasil Belajar Sejarah Kebudayaan Islam Pada Siswa Man Model Banda Aceh. *Pendalas: Jurnal Penelitian Tindakan Kelas Dan Pengabdian Masyarakat*, *2*(3), 160–174. https://doi.org/10.47006/pendalas.v2i3.129

Dinda, P. (2023). Model Pembelajaran Kooperatif Berbasis Script untuk Meningkatkan Keaktifan Belajar Siswa Sekolah Dasar. *Buletin Ilmiah Pendidikan*, *2*(2), 190–199. https://doi.org/10.56916/bip.v2i2.516

Dusalan, D., & Sowanto, S. (2023). Peningkatan Hasil Belajar Matematika dan Respon Siswa

Melalui Pembelajaran Kooperatif Tipe Jigsaw pada Siswa SMP Negeri 5 Wera. *Pedagogos: Jurnal Pendidikan*, *5*(1), 36–46. https://doi.org/10.33627/gg.v5i1.1239

Hartatik, S., Nafiah, N., Mariati, P., & Amin, S. M. (2024). Merancang Pembelajaran Matematika Yang Inovatif Dan Kreatif di SD Iskandar Said Surabaya. *Indonesia Berdaya*, *5*(1), 157–162. https://doi.org/10.47679/ib.2024648

Hasibuan, A., Setiawan, A., Daud, M., Siregar, W. V., Baidhawi, B., Hendrival, H., Kurniawan, R., & Safina, P. A. (2022). Peningkatan Kualitas Pembelajaran Melalui Variasi Pembelajaran Online di Kabupaten Aceh Singkil. *Jurnal Solusi Masyarakat Dikara*, *2*(2), 62–67. https://jsmd.dikara.org/jsmd/article/view/24

Juliarti, E. (2022). Upaya Meningkatkan Hasil Belajar Pendidikan Agama Islam dan Budi Pekerti melalui Cooperative Learning Tipe Jigsaw Pada Siswa Kelas V SDN 02 Sitiung. *International Journal of Technology Vocational Education and Training*, *3*(1), 12–22. https://doi.org/10.46643/ijtvet.v3i1.143

Jusriani, D., & Muchlis, I. (2023). Pengaruh Model Pembelajaran Kooperatif Tipe Jigsaw Terhadap Mata Pelajaran Akidah Akhlak Dalam Meningkatkan Minat Belajar Peserta Didik Di MTs Al Mustaqim Parepare. *Al-Ibrah: Jurnal Pendidikan Dan Keilmuan Islam*, *8*(2), 1–29. https://doi.org/10.61815/alibrah.v8i2.278

Kurnia, S. N. S. I. (2023). Pembelajaran kooperatif tipe jigsaw dalam meningkatkan motivasi belajar siswa. *Ta'limuna: Jurnal Pendidikan Islam*, *12*(1), 32–38. https://doi.org/10.32478/talimuna.v12i1.1137

Kurniawan, D. A., Sukarni, W., & Hoyi, R. (2021). Assessing Students' Attitudes towards Physics through the Application of Inquiry and Jigsaw Cooperative Learning Models in High Schools. *International Journal of Instruction*, *14*(4), 439–450. https://doi.org/10.29333/iji.2021.14426a

Leniati, B., & Indarini, E. (2021). Meta Analisis Komparasi Keefektifan Model Pembelajaran Kooperatif Tipe Jigsaw Dan Tsts (Two Stay Two Stray) Terhadap Kemampuan Berpikir Kritis Pada Pembelajaran Matematika Siswa Sekolah Dasar. *Mimbar Ilmu*, *26*(1), 149–157. https://doi.org/10.23887/mi.v26i1.33359

Mahfutri, A. E., & Fahyuni, E. F. (2023). Penerapan Metode Kooperatif tipe Jigsaw dengan menggunakan Strategi Active Learning terhadap Mata Pelajaran Pendidikan Agama Islam. *Jurnal Ilmiah Universitas Batanghari Jambi*, *23*(3), 2655–2661. https://doi.org/10.33087/jiubj.v23i3.4112

Mardiana, S., & Suharyanto, S. (2024). Upaya Meningkatkan Keaktifan Siswa melalui Model Pembelajaran Kooperatif Tipe Number Head Together (NHT) pada Mata Pelajaran IPAS Sekolah Dasar. *Ainara Journal (Jurnal Penelitian Dan PKM Bidang Ilmu Pendidikan)*, *5*(2), 177–184. https://doi.org/10.54371/ainj.v5i2.451

Møgelvang, A., & Nyléhn, J. (2023). Co-operative learning in undergraduate mathematics and science education: A scoping review. *International Journal of Science and Mathematics Education*, *21*(6), 1935–1959. https://doi.org/10.1007/s10763-022-10331-0

Nasir, N. I. R. F., Purwaningsih, E., Ekawati, R., & Yambi, T. D. A. C. (2024). An analysis of primary school students' scientific literacy. *Journal of Research in Instructional*, *4*(2), 623–634. https://doi.org/10.30862/jri.v4i2.544

Nawawi, M. L., Kurniawan, W., & Jamil, M. A. (2023). Implementasi Kurikulum Merdeka Dalam Pembelajaran Pendidikan Agama Islam (Pai) Di Lembaga Pendidikan Era

Society 5.0 (Studi Kasus Pada Sekolah Menengah Atas (Sma) Bustanul 'Ulum Anak Tuha). *Raudhah Proud To Be Professionals: Jurnal Tarbiyah Islamiyah*, *8*(3), 899–910. https://doi.org/10.48094/raudhah.v7i2.488

Nnamani, O., Hadebe-Ndlovu, B. N., Okeke, C. I., & Ede, M. O. (2023). Effect of Jigsaw and Team Pair-Solo cooperative learning strategies on interest in Basic Science of primary school children with visual impairment. *Psychology in the Schools*, *60*(7), 2430–2446. https://doi.org/10.1002/pits.22866

Nugraha, M. Y., Al Ghifari, B., Annur, S., & Handayani, T. (2025). Paradigma Baru dalam Pembelajaran: Strategi Efektif dan Efisien untuk Pendidikan Masa Depan. *Jurnal Review Pendidikan Dan Pengajaran*, *8*(1), 3112–3119. https://doi.org/10.31004/jrpp.v8i1.43125

Olivares, D., Lupiáñez, J. L., & Segovia, I. (2021). Roles and characteristics of problem solving in the mathematics curriculum: a review. *International Journal of Mathematical Education in Science and Technology*, *52*(7), 1079–1096. https://doi.org/10.1080/0020739X.2020.1738579

Pareira, J., Amsikan, S., & Salsinha, C. N. (2021). Upaya Meningkatkan Prestasi Belajar Matematika Siswa SMP Dengan Model Pembelajaran Kooperatif Tipe Jigsaw Pada Materi Himpunan. *Math Edu: Jurnal Ilmu Pendidikan Matematika*, *6*(2), 42–49. *https://doi.org/10.32938/jipm.6.2.2021*

Pasinggi, M. M. (2023). Implementasi model cooperative learning tipe jigsaw dalam meningkatkan hasil belajar fisika siswa sman 2 malinau. *Action: Jurnal Inovasi Penelitian Tindakan Kelas Dan Sekolah*, *3*(4), 243–251. https://doi.org/10.51878/action.v3i4.2539

Raditya, K. A., Gading, I. K., & Agustiana, I. G. A. T. (2023). Model pembelajaran kooperatif tipe jigsaw berbantuan media PowerPoint untuk meningkatkan kemampuan kolaborasi dan hasil belajar IPA siswa kelas V sekolah dasar. *Jurnal Media Dan Teknologi Pendidikan*, *3*(2), 84–93. https://doi.org/10.23887/jmt.v3i2.63116

Rahayu, S., Annur, S., & Diki, D. (2024). The effect of video-assisted jigsaw learning on students' motivation and science learning outcomes. *Journal of Research in Instructional*, *4*(1), 67–76. https://doi.org/10.30862/jri.v4i1.285

Rahmi, D. A., Ma'wa, J., & Alim, J. A. (2024). Analisi Metode Pembelajaran Kooperatif Jigsaw Untuk Meningkatkan Keaktifan Dan Hasil Belajar Siswa. *Lencana: Jurnal Inovasi Ilmu Pendidikan*, *2*(1), 35–41. https://doi.org/10.55606/lencana.v2i1.2970

Resmi, N. W. (2022). Model pembelajaran kooperatif tipe jigsaw untuk meningkatkan hasil belajar matematika pada siswa kelas IV Sekolah Dasar. *Journal of Education Action Research*, *6*(4), 546–551. https://doi.org/10.23887/jear.v6i4.52106

Sarumaha, W. F. (2023). Analisis Kemampuan Pemecahan Masalah Matematis Pada Materi Perpangkatan dan Bentuk Akar ditinjau dari Minat Belajar Siswa Kelas IX di SMPS Kristen BNKP Teluk Dalam TA. 2022/2023. *Afore: Jurnal Pendidikan Matematika*, *2*(2), 12–26. https://doi.org/10.57094/afore.v2i2.1101

Setiawan, I. N. S., Suma, K., & Suastra, I. W. (2024). Peningkatan Hasil Belajar IPA Melalui Model Pembelajaran Kooperatif Tipe Jigsaw pada Siswa Kelas V SD. *Jurnal Ilmiah Pendidikan Profesi Guru*, *7*(1), 32–38. https://doi.org/10.23887/jippg.v7i1.75654

Setyawan, N., & Prabawa, A. F. (2023). Kajian Literatur: Bisakah Konseling Kelompok Realita Meningkatkan Tanggung Jawab Belajar Siswa? *Proceedings of Annual Guidance and*

Counseling Academic Forum, 107–118. https://proceeding.unnes.ac.id/agcaf/article/view/2543

Silva, H., Lopes, J., Morais, E., & Dominguez, C. (2023). Fostering critical and creative thinking through the cooperative learning jigsaw and group investigation. *International Journal of Instruction*, *16*(3), 261–282. https://e-iji.net/ats/index.php/pub/article/view/80

Siregar, N. N., Firmansyah, F., Natasya, D., & Damopolii, I. (2025). Efektivitas Project Based Learning Berbantuan Wordwall untuk Meningkatkan Prestasi Belajar Ditinjau dari Rasa Ingin Tahu. *Cokroaminoto Journal of Primary Education*, *8*(1), 32–41. https://doi.org/10.30605/cjpe.812025.5338

Sriyanti, S., & Putri, N. D. A. (2023). Implementasi Media Boneka Jari Melalui Kegiatan Bercerita Dalam Mengembangkan Kemampuan Berbicara Anak Usia Dini. *Transformasi: Jurnal Penelitian Dan Pengembangan Pendidikan Non Formal Informal*, *9*(1), 51–61. https://doi.org/10.33394/jtni.v9i1.7297

Suhartini, S., & Buhaerah, B. (2022). Penerapan Model Kooperatif Tipe Jigsaw Terhadap Peningkatan Keaktifan Belajar Matematika. *Jurnal Ilmiah Pendidikan Matematika Al Qalasadi*, *6*(1), 9–15. https://doi.org/10.32505/qalasadi.v6i1.3718

Suriyanisa, S., Syamsuri, S., Ramadhan, I., & Wijaya, T. (2024). Implementasi Model Koperatif Tipe Jigsaw Berbasis Padlet Pada Pembelajaran Sosiologi untuk Meningkatkan Kerja Sama Peserta Didik Kelas XI di SMA Negeri 1 Pontianak. *Didaktika: Jurnal Kependidikan*, *13*(2), 2227–2240. https://doi.org/10.58230/27454312.558

Syaputri, N., Djazilan, M. S., Hartatik, S., & Rahayu, D. W. (2024). Penerapan Model Cooperative Learning Tipe Jigsaw dalam Meningkatkan Hasil Belajar Tematik Siswa Kelas III SDN Sumur Welut I Surabaya. *Enggang: Jurnal Pendidikan, Bahasa, Sastra, Seni, Dan Budaya*, *5*(1), 107–117. https://doi.org/10.37304/enggang.v5i1.18748

Syauqi, S. K., Winarno, N., Samsudin, A., Damopolii, I., & Firdaus, R. A. (2024). From online to in-person: Students' motivation and self-regulation in science teaching activities during and after the Covid-19 pandemic. *INSECTA: Integrative Science Education and Teaching Activity Journal*, *5*(1), 87–107. https://doi.org/10.21154/insecta.v5i1.8689

Thenu, D. M., Wambrauw, H. L., Budirianto, H. J., & Damopolii, I. (2023). Improving student learning outcomes through the use of Jigsaw learning. *Inornatus: Biology Education Journal*, *3*(1), 24–31. https://doi.org/10.30862/inornatus.v3i1.410

Ukobizaba, F., Nizeyimana, G., & Mukuka, A. (2021). Assessment Strategies for Enhancing Students' Mathematical Problem-Solving Skills: A Review of Literature. *Eurasia Journal of Mathematics, Science and Technology Education*, *17*(3). https://doi.org/10.29333/ejmste/9728

Utami, N. R. (2022). Jigsaw Type Cooperative Learning On Student Learning Outcomes In Algae Classification Practicum. *Report of Biological Education*, *3*(1), 17–32. https://doi.org/10.37150/rebion.v3i1.1624

Wang, M., Alavi, M., & Izadpanah, S. (2023). The impact of jigsaw cooperative learning on academic motivation, academic hardiness, and self-efficacy of English Foreign Language learners. *Learning and Motivation*, *84*, 101940. https://doi.org/10.1016/j.lmot.2023.101940

Widyaningsih, S. W., Yusuf, I., & Damopolii, I. (2019). Pelatihan penelitian tindakan kelas

bagi guru IPA Kabupaten Manokwari Papua Barat. *JMM (Jurnal Masyarakat Mandiri)*, 115. https://doi.org/10.31764/jmm.v0i0.1155

Wijayanto, S. M. (2022). Peningkatan Hasil Belajar PPKn Melalui Model Pembelajaran Kooperatif Tipe Jigsaw Di Sekolah Dasar. *Magistra: Media Pengembangan Ilmu Pendidikan Dasar Dan Keislaman*, *13*(2), 189–201. https://doi.org/10.31942/mgs.v13i2.7621

Winarno, N., Afifah, R. M. A., Sihombing, R. A., Firdaus, R. A., & Damopolii, I. (2025). Analyzing Misconceptions Using Four-tier Test on the Topic of Vibration: A Survey of Pre-service Science Teachers. *Unnes Science Education Journal*, *14*(1), 1–15. https://doi.org/10.15294/usej.v14i1.20612

Wowor, E. C., Tumewu, W. A., & Mokalu, Y. B. (2022). Implementasi Repetitive Method Melalui Kegiatan Refleksi Dalam Pembelajaran. *Soscied*, *5*(2), 272–279. https://doi.org/10.32531/jsoscied.v5i2.545

Yimer, S. T. (2022). Effective Instruction for Calculus Learning Outcomes through Blending Co-Operative Learning and Geogebra. *Mathematics Teaching Research Journal*, *14*(3), 170–189. https://mtrj.commons.gc.cuny.edu/the-editors-team/wp-content/uploads/sites/30/2022/10/Effective-Instruction-for-Calculus-Learning-Outcomes-through-Blending-co-operative-Learning-and-Geogebra.pdf

Yolanita, C., & Ruswendi, A. (2024). Analisis kesulitan belajar matematika di sekolah dasar. *Jurnal Pendidikan Dasar Flobamorata*, *5*(3), 464–470. https://doi.org/10.51494/jpdf.v5i3.1464

Yudha, C. B., Evayenny, E., & Herzamzam, D. A. (2021). Pengaruh Model Paikem Gembrot Terhadap Pembelajaran Kooperatif Type Jigsaw Pada Pembelajaran Matematika Di Sekolah Dasar. *Prima Magistra: Jurnal Ilmiah Kependidikan*, *2*(1), 66–76. https://doi.org/10.37478/jpm.v2i1.873

Zativalen, O., Tumardi, T., & Suhartono, S. (2022). Peningkatan sikap kerjasama melalui belajar kelompok dalam pembelajaran materi pecahan kelas V SD Muhammadiyah 1 Babat. *Jurnal Ilmiah Widya Pustaka Pendidikan*, *10*(1), 51–59. https://jiwpp.unram.ac.id/index.php/widya/article/view/58