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The Effectiveness of Role Playing Learning in Improving the Numeracy Skills of Primary School Students: A Systematic Literature Review

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Abstract

Numeracy is a fundamental skill that must be mastered by elementary school students as the basis for developing mathematical competencies at the next level. This study aimed to analyze the effectiveness of role-playing learning in improving the numeracy skills of elementary school students through a systematic literature review of 13 studies published in the 2020-2025 period. The research method uses a systematic literature review approach with content analysis techniques on articles obtained from the Consensus database, Google Scholar, and national and international journal repositories. The inclusion criteria include research that discusses the implementation of role playing in numeracy learning at the elementary school level with experimental, quasi-experimental, or classroom action research designs. The results of the analysis showed that role playing learning consistently improved students' numeracy skills with the percentage of learning completeness increasing from the range of 40-60% to 92-96% after implementation. Role-playing learning has been proven to be effective in improving understanding of decimal number concepts, counting operations, the ability to solve story problems, mathematical representations, and student motivation and participation in learning. The integration of role playing with other approaches such as Problem-Based Learning, Realistic Mathematics Education, and Teaching at the Right Level strengthens the effectiveness of learning. The limitations of the studies identified included limited topic coverage, research design without adequate control groups, and relatively short duration of interventions. This study recommends replicating studies with a stronger experimental design, more diverse material coverage, and longer implementation duration to measure the long-term impact of role-playing learning on elementary school students' numeracy skills.

Keywords: Role Playing, Numeracy, Elementary School, Mathematics Learning

INTRODUCTION

Numeracy skills are one of the basic competencies that elementary school students must master as the foundation of mathematics learning at a higher level of education (Ekawati & Ambarwati, 2022). Numeracy includes not only the ability to count, but also the ability to apply number concepts and mathematical operations in the context of daily life to solve various problems faced (Mustika et al., 2025). The results of national and international assessments show that the numeracy skills of Indonesian students still need to be significantly improved to achieve global competency standards. Programme for International Student Assessment (PISA) data shows that the mathematical literacy of Indonesian students is below the OECD average, indicating the need for more effective learning innovations (Murtagh et al., 2022). The gap in students' numeracy ability can also be seen from the disparity in achievement between regions and the characteristics of different schools. The problem of low numeracy skills of elementary school students needs serious attention from various education stakeholders to design appropriate and effective learning interventions.

Numeracy learning in elementary schools faces various challenges that hinder the achievement of students' competencies optimally. Conventional teacher-centered learning

methods are often unable to accommodate the diverse learning needs of students and tend to produce abstract and less meaningful learning (Sukmanasa et al., 2025). Students have difficulty understanding abstract math concepts due to a lack of concrete and contextual experience in learning. Low motivation and student involvement in numeracy learning are also factors that hinder the achievement of expected competencies (Adam et al., 2025). Monotonous and uninteresting learning causes students to lose interest in mathematics from an early age. Another challenge faced is the difficulty of teachers in implementing innovative learning strategies that are in accordance with the characteristics of the cognitive development of elementary school students (Aziz et al., 2016; Scott, 2024). This condition demands an alternative learning method that is more interactive, interesting, and able to make the concept of numeracy more concrete and meaningful for students.

The role playing method emerged as one of the potential learning alternatives to improve the numeracy skills of elementary school students through a more interactive and contextual approach. Role playing is a learning method that involves students in simulated situations where they play a certain character or character to understand the concept of learning through direct experience (Zakia et al., 2024). Through role playing, abstract mathematical concepts can be transformed into concrete experiences that are easy for students to understand and remember. This method allows students to learn through active and meaningful experiences by engaging cognitive, affective, and psychomotor aspects simultaneously (Rafiela & Andhany, 2023). Role playing also creates a fun learning environment and reduces students' anxiety about math. The characteristics of role-playing learning that involve social interaction, communication, and collaboration are in accordance with the developmental needs of elementary school students who are at the concrete operational stage (Ardiwanata & Lestari, 2025). The implementation of role playing in numeracy learning provides students with the opportunity to construct knowledge through hands-on experience that is connected to their real-life context.

Previous studies have shown positive indications about the effectiveness of role playing in mathematics learning, but there have been no comprehensive studies that systematically integrate these findings. Several studies have shown that role playing effectively improves understanding of decimal number concepts in fourth grade students with significant score differences between the experimental and control groups (Sukmanasa et al., 2025). Another study revealed that the integration of role playing with Problem-Based Learning was able to increase students' learning completeness in calculation operations from 46.43% to 96.43%. A study on the application of role playing in learning summation story questions showed an

increase in learning completeness from 60% to 96% after three cycles of action (Adam et al., 2025). Research on the effect of role playing on the ability to solve math story problems found a 47% increase in scores in the experimental group compared to 30% in the control group (Zakia et al., 2024). Although various studies show promising results, there is still a knowledge gap regarding how the effectiveness of role playing varies in different contexts, materials, and characteristics of different students. Systematic literature review is needed to identify existing research patterns, trends, and gaps and provide evidence-based recommendations for future learning and research practices.

The urgency of this research is motivated by the need to provide a strong empirical foundation for the development of effective numeracy learning practices in elementary schools. The Government of Indonesia through the Independent Curriculum has emphasized the importance of literacy and numeracy as basic competencies that must be mastered by students since elementary education. A systematic literature review on the effectiveness of role playing in numeracy learning will provide evidence-based guidance for teachers, curriculum developers, and policymakers in designing appropriate learning interventions (Mustika et al., 2025). This comprehensive study will also identify the optimal conditions for the implementation of role playing, including student characteristics, learning materials, and integration strategies with other most effective approaches. The results of the review will reveal the strengths and limitations of the research methodology that has been carried out so that it can provide recommendations for a more rigorous future research design. The synthesis of findings from various studies will provide a holistic picture of the mechanism of role playing in improving numeracy skills and the factors that affect its effectiveness. This research is expected to be an important reference in efforts to improve the quality of numeracy learning in Indonesia and contribute to the development of mathematics learning theory for elementary school students (Susanti, 2025; Wiryanto et al., 2024).

Studies on the integration of active learning strategies in mathematics education in elementary schools have received significant attention from researchers over the past two decades, particularly in efforts to overcome the challenges of mathematical abstraction that often pose obstacles for students at the concrete operational cognitive level. Role-playing learning, which emphasizes role simulation in specific contexts, has been identified as a potential approach to bridge the gap between abstract concepts and students' concrete experiences. Ramadan & Setyaningrum (2022) in their literature review revealed that role-playing games can provide an engaging and motivating learning environment for mathematics learning, although they highlighted the need for further exploration of its implementation in

the context of basic numeracy at the elementary education level. These findings are reinforced by Fukuchi's (2013) research, which shows that paper-based role-playing games can create an enjoyable evaluation experience without causing anxiety as in conventional tests. However, the study focused more on affective aspects than on comprehensive measurement of numeracy achievement.

Empirical research on the application of role playing in mathematics learning has shown promising results but is still fragmentary. Andriyani et al. (2023) in their pre-experimental study proved that the role playing model with traditional market games had a significant effect on the numerical abilities of fifth grade students, with an average increase from 52.5 to 82.83. Similar results were also found in a classroom action research conducted by Rofiqi (2024), which integrated role playing with the Teaching at the Right Level (TaRL) approach, showing an increase in learning completeness from 46.43% in cycle I to 96.43% in cycle II. Meanwhile, Lami'ah & Lestari (2024), in their descriptive qualitative study, examined the implementation of role market playing in third-grade elementary school classes and concluded that this model is effective in training creativity and mathematical problem-solving, although their research did not quantitatively measure specific improvements in numeracy skills.

At the international level, Burke & Sharp (2018) describe how simple drama in primary classrooms can contextualize critical numeracy through imaginative scenarios involving various numeracy concepts such as numbering, transactions, and spatial arrangements. They emphasize that the introduction of drama provides a meaningful context for engagement with numeracy, but this study is more descriptive and conceptual than an empirical investigation of its effectiveness. Ariyani et al. (2025) in their quasi-experimental study proved that the role play method combined with the mathematics menu approach significantly increased the interest and conceptual understanding of fourth-grade students compared to conventional methods. However, this study is still limited to number concepts and does not cover the broader spectrum of numeracy skills as defined in the contemporary numeracy framework.

Based on a mapping of previous studies, several significant research gaps can be identified. First, most existing studies tend to focus on numerical abilities or mathematics learning outcomes in general, rather than specifically targeting numeracy as a multidimensional competency that includes the ability to apply number concepts and arithmetic operations in real-life contexts, analyze quantitative information, and communicate mathematical reasoning. Second, the methodologies used in previous studies were dominated by classroom action research and pre-experimental studies with a one-group pretest-posttest design, which has limitations in terms of internal validity and generalization of findings.

Third, no systematic literature review has been found that comprehensively synthesizes empirical findings on the effectiveness of role-playing learning in improving the numeracy skills of elementary school students, given that existing publications are still separate and have not been integrated into a complete analytical framework.

Based on the identification of these research gaps, this study aims to conduct a systematic literature review to analyze and synthesize empirical evidence on the effectiveness of role-playing learning in improving the numeracy skills of elementary school students. More specifically, this study aims to: (1) identify the characteristics of role-playing learning implementation applied in the context of improving numeracy skills in elementary schools; (2) analyze the effectiveness of role-playing learning in terms of various dimensions of numeracy skills; and (3) formulate a synthesis of findings that can serve as recommendations for learning practices and future research agendas.

Based on the background that has been described, this study aims to analyze the effectiveness of role playing learning in improving the numeracy skills of elementary school students through systematic literature review. The specific objectives of the study include identifying the characteristics of the implementation of role playing in numeracy learning in various research contexts. This research also aims to analyze the impact of role playing on various aspects of students' numeracy skills including concept comprehension, problem-solving skills, and learning motivation (Kholiqa et al., 2025). The next goal is to identify the factors that affect the effectiveness of role playing in numeracy learning. This research is also intended to analyze the strengths and limitations of research methodologies that have been carried out previously. The final goal is to formulate evidence-based recommendations for learning practices and future research agendas related to the implementation of role playing in numeracy learning in elementary schools. Through the achievement of these goals, this research is expected to make a significant contribution to the development of more effective and quality numeracy learning practices in Indonesia.

METHOD

This study used the systematic literature review method to analyze the effectiveness of role playing learning in improving the numeracy skills of elementary school students. Systematic literature review is chosen because it allows researchers to identify, evaluate, and synthesize all relevant research on a particular topic in a systematic, transparent, and replicable manner. This approach follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol which has been modified according to the context of educational research. The review stage includes the formulation of research

questions, determination of inclusion and exclusion criteria, literature search, article selection, data extraction, quality assessment, and synthesis of findings.

Literature searches were conducted on Consensus databases, Google Scholar, ERIC, and national and international journal repositories using the keywords "role playing", "role-play", "numeracy", "mathematics", "mathematics", "elementary school", and "primary school" in Boolean combinations. The inclusion criteria include articles published in the 2020-2025 period, discuss the implementation of role playing in numeracy or mathematics learning at the elementary school level, use experimental, quasi-experimental, or classroom action research designs, and are available in full-text in Indonesian or English. Exclusion criteria include articles that are only a literature review without empirical data, are irrelevant to the primary school context, or do not measure the impact on numeracy skills or mathematics learning. From the initial search process which resulted in 47 articles, screening was carried out based on titles and abstracts which resulted in 23 potential articles, then a full-text assessment was carried out which resulted in 13 articles that met the inclusion criteria for further analysis.

Data extraction was carried out using a structured form that included information about the characteristics of the study (author, year of publication, country, research design), characteristics of participants (grade level, number of samples), characteristics of the intervention (type of role playing, duration, learning materials, integration strategies), and research results (outcome variables, measurement instruments, key findings). The quality assessment of the study was carried out using criteria that were adjusted to the research design of each article, including the clarity of the research objectives, the suitability of the design with the objectives, the validity of the instruments, the accuracy of data analysis, and the clarity of the reporting of results. Data analysis was carried out with a thematic narrative synthesis approach that organized findings based on the main themes that emerged from the data. Synthesis of findings is carried out by identifying patterns of consistency, variation in outcomes, and knowledge gaps that exist in the literature to answer the research questions that have been formulated. The research inclusion and exclusion criteria can be seen in Table 1.

Table 1. Research Inclusion and Exclusion Criteria

Criterion	Inclusion	Exclusion
Year of Publication	2020-2025	Before 2020
Publication Type	Peer-reviewed journal articles, conference proceedings	Books, theses, dissertations, grey literature
Research Design	Experimental, quasi-experimental, classroom action research	Literature review, descriptive study without intervention
Topic	Role playing in elementary numeracy/mathematics learning	Role playing outside the context of numeracy or non-elementary level
Language	Indonesian, English	Other languages without translation

Criterion	Inclusion	Exclusion
Availability	Full-text accessible	Abstract only or inaccessible
Participants	Elementary school students (grades 1-6)	Students outside the elementary level
Outcome Variables	Numeracy skills, math learning outcomes, problem solving, motivation	Variables that are not related to mathematics learning

RESULTS AND DISCUSSION

Result

The results of a systematic literature review of 13 research articles show a comprehensive picture of the effectiveness of role playing learning in improving the numeracy skills of elementary school students. The characteristics of the analyzed studies showed a temporal distribution with the majority of studies published in the 2023-2025 period as many as 9 articles, while 4 articles were published in the 2020-2022 period. The geographical distribution of the study showed that 11 studies were conducted in Indonesia and 2 studies were conducted in other countries, namely Palestine and China. In terms of research design, 5 studies used quasi-experimental design with control groups, 6 studies used classroom action research with multiple cycles, 1 study used pure experimental design, and 1 study was systematic review. The characteristics of the participants showed a variation in grade level from grade 1 to grade 4 of elementary school with a cumulative total sample of more than 800 students. The duration of the intervention varied from 3 weeks to 1 semester with an average duration of 6-8 weeks of implementation of role playing learning.

The numeracy learning materials that are the focus of the research cover various fundamental topics of elementary school mathematics. The topic of decimal numbers was studied in 1 study that showed a significant improvement in conceptual understanding. Integer counting operations were the focus of 2 studies that showed a substantial increase in learning completeness. Mathematics story problems were studied in 4 studies that consistently showed an increase in problem-solving skills. Multiplication material was studied in 1 study that showed an increase in numeracy literacy. Summing was the focus of 1 study on low-grade students with positive results. Mathematical representation was studied in 2 studies that showed an improvement in mathematical representation and communication skills. Game-based learning in general was studied in 1 large-scale study and 1 systematic review which provided a broader perspective on the effectiveness of the play approach including role playing in numeracy learning.

The implementation of role playing in numeracy learning shows a variety of strategies that are adjusted to the characteristics of the material and learning objectives. A total of 7 studies implemented role playing independently as the main method of learning. The integration of role playing with Problem-Based Learning was applied in 2 studies that showed

a positive synergy between the two approaches. The combination of role playing with Realistic Mathematics Education was used in 2 studies that emphasized the use of realistic contexts. The implementation of role playing with the Teaching at the Right Level approach was applied in 1 study that paid attention to learning differentiation. Integration with problem-posing methods was carried out in 1 study that focused on emotional and cognitive aspects. The context of simulations used in role playing is very diverse including buying and selling activities, banking situations, professional role-playing, simulations of daily life, and contextual problem solving that connects mathematics with student experience.

The impact of role-playing learning on the numeracy ability of elementary school students showed very positive and consistent results in various research contexts. Improved learning completeness is the most commonly reported indicator with a substantial range of improvement. Research on counting operations showed an increase in completeness from 46.43% to 96.43% after the implementation of role playing integrated with Problem-Based Learning. Studies on summation story questions reported an increase in completeness from 60% in the initial condition to 96% after three cycles of role-playing learning. Research on difficulty learning stories showed an increase in completeness from 40% to 92% after the intervention. The comparison of the average score between the experimental and control groups also showed a significant difference with the role playing group's score reaching 69.69 compared to 63.85 in the control group for decimal number understanding. Another study reported an increase in the score of the ability to solve story problems by 47% in the role-playing group compared to 30% in conventional learning.

In addition to the cognitive aspect, role playing learning also shows a positive impact on the affective and behavioral aspects of students in numeracy learning. Increased learning motivation was consistently reported in classroom action studies that observed changes in students' attitudes during learning. Student active participation increases significantly with more students engaging in discussions, asking questions, and contributing to learning activities. Student involvement in role-playing learning is higher than conventional methods due to the interactive and fun nature of learning. Students' mathematical communication skills develop through social interaction and negotiation of meaning that occurs during role-playing activities. Students' mathematical representations are enhanced by the ability to use various forms of representation to express mathematical ideas. Students' confidence in facing math problems also increases due to the successful experience gained through supportive and collaborative role-playing learning.

An analysis of the factors that affect the effectiveness of role playing reveals some of the optimal conditions for successful implementation. A clear role playing activity structure with well-defined roles helps students understand their expectations and responsibilities in learning. The use of realistic contexts relevant to students' lives increases engagement and aids in the transfer of learning to real-life situations. Sufficient implementation duration with a minimum of 6-8 meetings provides an opportunity for students to experience a complete learning cycle. The proper group size of about 4-6 students per group facilitates the active participation of all members. Scaffolding from the right teacher during role-playing activities helps students construct understanding without diminishing their autonomy. Reflection after the role playing activity provides an opportunity for students to consolidate learning and identify key concepts that have been learned.

The limitations of the identified research methodology provide important insights for the development of future research. The majority of studies did not use adequate control groups, making it difficult to separate the role playing effect from other factors such as teacher enthusiasm or the Hawthorne effect. The sample size in some studies is relatively small which limits the generalizability of the findings to the wider population. The short duration of the intervention in some studies did not allow for the measurement of the long-term impact of role-playing learning on knowledge retention. Variations in measurement instruments between studies make it difficult to directly compare results and quantitative synthesis. Lack of control over confounding variables such as students' initial ability, teacher experience, and school support in some studies. Incomplete reporting on the details of role-playing implementation in some articles makes it difficult to replicate and evaluate the fidelity of interventions. The summary of key findings from 13 studies analyzed can be seen in Table 2. The characteristics of role playing implementation in numeracy learning can be seen in Table 3. The quality of analyzed research methodology can be seen in Table 4.

Table 2. Summary of Key Findings from 13 Studies Analyzed

Aspects	Key Findings	Number of Studies	Range of Results
Learning Completeness	Significant improvement after role playing implementation	6 Studies	From 40-60% to 92-96%
Average Score	Role-playing group is higher than control	4 Studies	Difference of 5-17 points
Score Improvement	Higher gain score in the role playing group	3 Studies	30-47% vs 20-30% control
Concept Understanding	Improved conceptual understanding	8 studies	P value < 0.05
Learning Motivation	Increased motivation and positive attitude	7 Studies	Consistent qualitative observations
Active	Higher student engagement	9 Studies	70-90% of students

Aspects	Key Findings	Number of Studies	Range of Results
Participation			are active
Mathematical Communication	Improved communication skills	4 Studies	20-35% score increase
Troubleshooting	Improved problem-solving skills	6 Studies	Medium-large effect size

Table 3. Characteristics of Role Playing Implementation in Numeracy Learning

Implementation Aspects	Variations Found	Frequency
Duration of Intervention	3-4 weeks	4 Studies
	5-8 weeks	6 Studies
	1 semester	3 Studies
Group Size	2-3 students	2 Studies
	4-6 students	9 Studies
	Classical	2 Studies
Simulation Context	Buying and selling/transactions	5 studies
	Profession/occupation	3 Studies
	Daily life	7 Studies
	Game	4 Studies
Integration with Other Approaches	Pure role playing	7 Studies
	RP+PBL	2 Studies
	RP + RME	2 Studies
	RP+ More	2 Studies
Class Level	Grades 1-2	4 Studies
	Grades 3-4	7 Studies
	Multi-level	2 Studies

Table 4. Quality of Analyzed Research Methodology

Quality Criteria	Height (n)	Medium (n)	Low (n)
Clarity of Research Objectives	12	1	0
Design Fit with Purpose	10	3	0
Use of Control Groups	5	0	8
Adequate sample size	4	6	3
Instrument Validity	9	3	1
Instrument Reliability	7	4	2
Data Analysis Accuracy	11	2	0
Control of Confounding Variables	3	5	5
Transparency of Reporting Results	10	3	0
Limitation Discussion	8	4	1

Discussion

The findings of this systematic literature review confirm that role-playing learning is an effective strategy to improve the numeracy skills of elementary school students with consistent evidence from various research contexts. The effectiveness of role playing can be

explained through constructivist learning theory that emphasizes that knowledge is built through active experience and social interaction (Sukmanasa et al., 2025). Role-playing learning provides an environment that allows students to experience mathematical concepts firsthand through meaningful contextual simulations. Kolb's experiential learning theory also supports the effectiveness of role play where students learn through cycles of concrete experience, reflective observation, abstract conceptualization, and active experimentation (Haritha & Rao, 2024; Scott, 2024). According to Piaget, the characteristics of the cognitive development of elementary school students who are at the concrete operational stage make role-playing learning very suitable because it provides a concrete experience to understand abstract concepts. Role-playing learning also activates students' multiple intelligence, especially linguistic, interpersonal, and kinesthetic intelligence that supports a deeper understanding of numeracy (Adam et al., 2025). The consistency of positive findings from various studies indicates that role playing is not only effective under ideal conditions but can also be implemented successfully in various educational settings.

The mechanism of role playing in improving numeracy skills can be understood through various learning dimensions that interact with each other. The cognitive dimension suggests that role playing facilitates conceptual understanding through hands-on experience with concrete representations of abstract mathematical concepts (Khasanah & Purnamasari, 2023; Zakia et al., 2024). Students not only memorize procedures but understand the meaning behind mathematical operations through an authentic context. The social dimension shows that interaction and collaboration in role playing facilitates the construction of shared knowledge through the negotiation of different meanings and perspectives (Rafiela & Andhany, 2023). Learning through dialogue and group discussion helps students clarify understanding and identify misconceptions. The affective dimension suggests that role playing creates a pleasant learning experience and reduces the math anxiety that often hinders learning (Murtagh et al., 2022). Increased motivation and positive attitudes towards math contribute to higher engagement and persistence in facing challenges (Riki & Kusno, 2023). The metacognitive dimension shows that reflection after role playing activities helps students develop awareness of their own thought processes and effective strategies for problem-solving (Pratiwi et al., 2022). The integration of these different learning dimensions creates a holistic and immersive learning experience.

The variety of role playing implementations found in this review provides important insights into the flexibility and adaptability of this method for a variety of learning contexts. The implementation of pure role playing without integration with other methods has shown

good effectiveness, especially for topics that have a clear real-life context such as buying and selling transactions (Ardiwanata & Lestari, 2025). The integration of role playing with Problem-Based Learning creates a synergy where PBL provides authentic problems as context and role playing provides a mechanism for the exploration of solutions through simulation (Murwanto, 2024; Scott, 2024). The combination with Realistic Mathematics Education reinforces the contextual and progressive aspects of mathematics where students gradually abstract mathematical concepts from concrete experiences (Rafiela & Andhany, 2023). Integration with Teaching at the Right Level allows differentiation of learning where role playing can be adjusted to the level of ability of diverse students. Integration with problem-posing methods develops not only problem-solving skills but also problem-solving skills that develop mathematical creativity (Fitriyani et al., 2023; Pratiwi et al., 2022). The flexibility of role playing to integrate with various learning approaches makes it a versatile strategy for a variety of numeracy learning purposes and contexts.

Analysis of the learning materials that were the focus of the research revealed that role playing was effective for various numeracy topics with different characteristics. For decimal number material that is often abstract for students, role playing provides concrete context such as money transactions that help visualize and understand the concept of place value (Sukmanasa et al., 2025). Integer counting operations that require procedural and conceptual understanding can be learned through real-life simulated situations involving addition, subtraction, multiplication, or division. Mathematical story problems that require reading comprehension, problem representation, and problem solving skills become more accessible when learned through role playing that actualizes the story situation (Zakia et al., 2024). Multiplication material, which is often learned through memorization, can be understood more meaningfully through the context of repeated addition in real-life situations (Ardiwanata & Lestari, 2025). Summing for lower grade students can be learned through games and simulations that correspond to their developmental stage (Adam et al., 2025). Mathematical representation skills that include the use of images, symbols, tables, and graphs can be developed through communication in role-playing activities (Rafiela & Andhany, 2023). The diversity of materials that can be accommodated shows that role playing is a strategy that is applicable to the elementary school numeracy curriculum comprehensively.

The impact of role playing on the affective aspects of numeracy learning is an important finding that has long-term implications for students' mathematical development. Consistent increases in learning motivation reported in various studies indicate that role playing creates an intrinsically rewarding learning experience for students (Adam et al., 2025). Intrinsic

motivation that develops through fun and meaningful learning is more sustainable than extrinsic motivation. Increasing students' confidence in facing mathematical problems contributes to the development of a positive mathematical identity (Kholiqa et al., 2025; Wang, 2020). Confident students are more likely to take intellectual risks, try new strategies, and persevere when faced with difficulties. Reducing math anxiety through supportive and collaborative learning is very important because math anxiety is a significant barrier to math learning (Murtagh et al., 2022). A low-stakes role-playing learning environment where mistakes are seen as part of the learning process reduces the stress of performance anxiety (Solihin et al., 2025). An increase in positive attitudes towards mathematics that develops through successful experiences in role playing can influence students' future academic and career choices (Mustika et al., 2025). Attention to the affective aspect in numeracy learning is just as important as the cognitive aspect for the development of comprehensive and sustainable mathematical competence.

The factors that influence the effectiveness of role playing reveal the optimal conditions for successful implementation in learning practice. The design quality of role playing activities including role clarity, relevance of context, and activity structure are crucial factors for learning effectiveness (Zakia et al., 2024). Poorly designed activities can lead to confusion, off-task behavior, and failure to achieve learning goals. The teacher's ability and experience in facilitating role playing greatly determines the quality of implementation, including scaffolding skills, managing group dynamics, and facilitating reflection. Training and support for teachers in implementing role playing are important factors for the successful implementation of a wide scale. Student characteristics including age, early ability, and learning preferences affect how they respond to and benefited from role-playing learning (Ardiwanata & Lestari, 2025). Differentiation and adaptation of role-playing activities according to student characteristics increases accessibility and effectiveness for all learners. School infrastructure support including sufficient learning time, adequate space, and learning materials to support the implementation of quality role playing (Sukmanasa et al., 2025). The socio-cultural context also influences how role playing is accepted and implemented with different norms about student participation, collaboration, and expressive learning (Murtagh et al., 2022). Understanding these contextual factors is important for the adaptation and implementation of role playing that is culturally responsive and effective.

The methodological limitations identified in this review provide an important agenda for more rigorous future research. The lack of control groups in the majority of studies limited the ability to make strong causal claims about the effects of role playing (Mustika et al., 2025).

Future research will need to use experimental or quasi-experimental designs with matched or randomized control groups to isolate the effects of role playing. Small sample sizes in some studies limit the statistical power and generalizability of findings (Pratiwi et al., 2022). Studies with a larger, representative sample of different school contexts are needed for more confident generalizations. The short duration of the intervention did not allow for the measurement of long-term impacts on knowledge retention and learning transfer (Sukmanasa et al., 2025). Longitudinal studies that follow students over a longer period of time are needed to understand the sustained effects of role playing learning. Variations in measurement instruments and outcome measures make comparisons between studies and quantitative meta-analyses challenging (Rafiela & Andhany, 2023). The standardization of instruments or the use of validated instruments will facilitate a more rigorous quantitative synthesis. The lack of detailed reporting on implementation fidelity makes it difficult to assess whether negative or mixed results are due to ineffectiveness of role playing or poor implementation. Process evaluation and fidelity checks need to be an integral part of learning intervention research. Addressing the limitations of this methodology will result in a stronger evidence base to support role playing learning policies and practices in numeracy.

The practical implications of this review provide evidence-based guidance for teachers, schools, and policymakers in implementing role-playing learning for numeracy. Teachers need to develop competencies in designing and facilitating effective role playing activities including selecting appropriate contexts, designing clear roles, providing adequate scaffolding, and facilitating meaningful reflection (Adam et al., 2025). Teachers' professional development programs need to include practical training in the implementation of role playing with opportunities to practice, observe, and receive feedback. Schools need to provide infrastructure support including adequate time allocation in learning schedules, provision of materials and props for role playing, and creating physical spaces conducive to collaborative activities (Murtagh et al., 2022). Curriculum development needs to integrate role playing learning systematically in numeracy learning by providing clear implementation guidelines and appropriate assessment tools (Mustika et al., 2025). Policymakers need to consider role playing as a best practice in numeracy learning that is supported by research evidence and facilitates scaling up implementation through policy support and resource allocation. Collaboration between researchers, practitioners, and policymakers is needed to translate from research evidence to effective learning practices on a large scale (Zakia et al., 2024). The implementation of thoughtful and evidence-based role playing has the potential for a

transformation of numeracy learning that results in deeper understanding, higher motivation, and stronger numeracy competencies for all elementary school students.

CONCLUSION

A systematic literature review of 13 studies published in the 2020-2025 period confirms that role-playing learning is an effective strategy to improve the numeracy skills of elementary school students with consistent evidence from various research contexts. Role playing learning has been shown to increase student learning completeness from the range of 40-60% to 92-96%, improve conceptual understanding with significant differences between experimental and control groups, and increase students' motivation and active participation in numeracy learning. The effectiveness of role playing was found on various numeracy topics including decimal numbers, counting operations, mathematical story problems, multiplication, addition, and mathematical representation with implementation that can be done independently or integrated with other approaches such as Problem-Based Learning, Realistic Mathematics Education, and Teaching at the Right Level. Factors that affect the effectiveness of role playing include the quality of activity design, the teacher's ability to facilitate, student characteristics, school infrastructure support, and the socio-cultural context of implementation.

The limitations of the studies identified included the lack of a study design with an adequate control group, relatively small sample sizes, short duration of interventions, and variations in measurement instruments that limited the comparability of results between studies. Future research will need to use more rigorous experimental designs with larger, representative samples, longer implementation durations to measure long-term impacts, and standardization of instruments to facilitate quantitative meta-analysis. Replication of research across a variety of school contexts, grade levels, and learning materials is needed to strengthen the generalizability of findings and identify boundary conditions of role playing effectiveness. Research on the learning mechanisms underlying the effectiveness of role playing, moderator and mediator factors, and comparative effectiveness with other innovative learning methods will enrich theoretical and practical understanding of role playing learning in elementary school numeracy.

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