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Elementary School Mathematics Learning Strategies: An Empirical Study Analysis

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ABSTRACT

This study aims to analyze various mathematics learning strategies in elementary schools that have been developed and empirically tested over the past five years, to provide a comprehensive overview of their trends, effectiveness, and relevance to 21st-century learning needs. This is due to the low mathematical literacy achievements of Indonesian students in PISA, TIMSS, and the National Assessment, which indicates that the dominance of conventional teacher-centered methods remains an obstacle in developing critical thinking, creativity, and problem-solving skills. The research method used was a Systematic Literature Review (SLR) with reference to the PRISMA guidelines. The search process was conducted in the *Google Scholar database* with specific keywords and focused on articles indexed SINTA 1-5, published between 2020-2025, and containing empirical data in the context of elementary mathematics learning. Of the 1,600 identified articles, five articles were screened that met the inclusion criteria and were further analyzed. The results showed that innovative learning strategies consistently improve learning outcomes, motivation, and higher-order thinking skills. The traditional game-based GASING method has been proven to increase motivation and conceptual understanding, the TGT model assisted by Articulate Storyline strengthens student interest and engagement, the integration of ethnomathematics with Augmented Reality encourages problem-solving and critical thinking skills, the environment-based STAD connects mathematics with real contexts, while PBL assisted by manipulative media deepens the understanding of abstract concepts. Therefore, it can be concluded that innovative, contextual, collaborative, and technology-based mathematics learning strategies are the answer to the numeracy achievement gap in elementary schools. The combination of concrete and digital media, integration of local contexts, and collaboration-based learning has the potential to reduce the achievement gap between students while improving the quality of elementary mathematics education in Indonesia.

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Introduction

Mathematics is one of the fundamental subjects that plays an important role in developing logical (Saputra, 2024) , analytical (Dores et al., 2020) , systematic (Jannah et al., 2024) , critical (Witono & Hadi, 2025) , and creative (Hidayati et al., 2025) thinking skills in students from an early age. In the context of elementary education, mathematics learning has a strategic goal in equipping students to have adequate numeracy skills (Purwoko, 2025) , problem-solving skills (Widad & Hadi, 2025) , and understanding concepts that can be applied in everyday life (Kharismayanda et al., 2025) . This is in line with the objectives of the National Curriculum currently being implemented, which emphasizes that mathematics learning in elementary schools must be carried out with a fun, interactive approach and encourage active student involvement. For this reason, teachers are expected to be able to integrate various learning strategies that are appropriate to the characteristics of the material, the level of students' cognitive development, and the demands of 21st century competencies.

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On the other hand, previous research also emphasizes the importance of student-centered learning strategies in improving understanding of mathematical concepts (Pasaribu et al., 2025) . Approaches such as *problem-based learning* (Muhdantiar & Kasriman, 2025) , *discovery learning* (Rahmiyati et al., 2025), and realistic mathematics education (Pasaribu et al., 2025) are also useful. (Mangundap et al., 2025) , project-based learning (Ladisya et al., 2025) , and the use of digital technology (Barokah & Mahmudah, 2025) have been shown to increase interest, motivation, and mathematics learning outcomes at the elementary school level. Furthermore, several studies have shown that contextual and collaborative learning can help reduce differences in learning outcomes between students with different initial abilities because the material is easier to understand. Therefore, conceptually and normatively, the direction of mathematics learning development in elementary schools has a strong foundation, both in terms of policy and educational theory.

However, the reality on the ground shows that the implementation of mathematics learning in elementary schools in Indonesia still faces various challenges. Data from the 2018 *Programme for International Student Assessment* (PISA) shows that Indonesian students' mathematical literacy achievement ranks low among participating countries, with an average score far below the OECD average. The *Trends in International Mathematics and Science Study* (TIMSS) results also show a similar pattern, with most students only able to solve low-level, procedurally oriented math problems. Findings from the 2022 National Assessment (AN) from the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) also indicate that elementary school students' numeracy skills in various regions still vary and tend to be low, particularly in the aspects of reasoning and problem-solving.

One of the main causes of this low achievement is the dominance of conventional teacher *-centered learning methods,* where the teaching and learning process is more directed at delivering material and routine practice problems without providing sufficient space for exploration of concepts and the application of mathematics in real contexts. Many teachers tend to focus on completing the curriculum administratively, so they do not prioritize approaches that can develop higher-order thinking skills (*HOTS*). In addition, limited professional training, minimal supporting facilities, and low utilization of learning technology also contribute to the obstacles to innovation in mathematics learning in elementary schools.

Referring to these conditions, a gap exists between the potential of learning strategies proven effective based on empirical research and the dominant learning practices in elementary schools. Furthermore, numerous empirical studies, both in Indonesia and other countries, have identified a variety of effective mathematics learning strategies. However, this information remains scattered across publications, across different contexts, and using diverse methodological frameworks. The resulting impact is that teachers, policymakers, and researchers struggle to obtain a comprehensive picture of which strategies are most relevant and effective for application in elementary school contexts in Indonesia. Furthermore, most existing research focuses on small-scale trials or specific contexts, thus limiting the generalizability of the results.

This research gap highlights the need for a systematic literature review to integrate and analyze empirical findings related to mathematics learning strategies in elementary schools, particularly over the past decade. A *systematic literature review* (SLR) approach can be used to critically collect, evaluate, and synthesize relevant research findings, resulting in a clear mapping of trends, strengths, weaknesses, and opportunities for developing mathematics learning strategies in elementary schools. SLRs also enable researchers to identify underexplored research areas and offer evidence-based recommendations for improving future learning practices.

Method

This study uses the *Systematic Literature Review* (SLR) method with reference to the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to identify, evaluate, and synthesize the results of empirical research related to mathematics learning strategies in Elementary Schools (SD) over the past 5 years. Data sources were obtained from SINTA 1-5 accredited journals through a search on the Google Scholar* database using a combination of keywords such as, elementary mathematics learning strategies, *Realistic Mathematics Education, Problem-Based Learning,* elementary mathematics learning media, and *elementary mathematics learning strategies.* The included articles met the following criteria: published in SINTA 1-5 journals, focused on elementary mathematics learning (grades I-VI), contained empirical data (experimental, quasi-, CAR, R&D, or qualitative) published in 2020-2025. Articles were excluded if they did not specifically discuss SD, were not empirical research, or were in the form of proceedings/thesis/dissertations that had not been published in accredited journals. The data collection process includes four PRISMA stages: identification (article search), selection (title and abstract screening), eligibility (*full text checking*), and inclusion (determination of final articles for analysis).

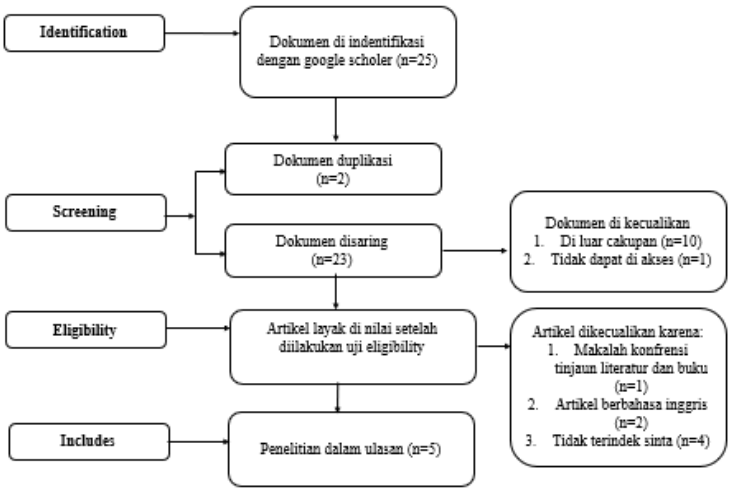

Figure 1. *Prisma Flowchart*

Results and Discussion

Based on the primary search in this study, 1,600 articles were identified that matched the keywords used in the search. Afterwards, a selection process was conducted based on inclusion and exclusion criteria, resulting in five relevant articles for further analysis. For more details, these five articles are as follows.

Table 1. Article review results

No	Title & Author (Year)	Method	Results
1	*The Gasing Method with the Traditional Game-Based Mong-Mongan Number Approach to Improve Mathematics Learning Outcomes* (Sariningsih et al., 2025) .	Experiment, *pretest-posttest control group design,* lower grade elementary school students	The GASING method + mong-mongan game improves mathematics learning outcomes and motivation compared to conventional learning.

No	Title & Author (Year)	Method	Results
2	*The Effect of Team Games Tournament (TGT) Model-Assisted Articulate Storyline on Student Learning Outcomes and Interest.* (Sekarsari & Rusnilawati, 2023) .	Quasi-experimental, *nonequivalent control group,* elementary school students	TGT + Articulate Storyline media improves student learning outcomes and interest; learning is more engaging and easier to understand.
3	*Ethnomathematics-Collaborative Augmented Reality Framework to Improve Problem-Solving Ability of Elementary Students.* (Jampel & Antara, 2025) .	Experiment, middle grade elementary school students	Ethnomathematics + Augmented Reality effectively improves students' problem-solving, critical thinking, and creativity skills.
4	*Environmentally Based STAD Type Cooperative Learning in Mathematics Learning.* (Ayada & Tegeh, 2023) .	Quantitative, quasi-experimental, elementary school students	Environment-based STAD enhances learning outcomes, collaborative interactions, and the connection of mathematics to real life.
5	*Problem-Based Learning with Manipulative Media to Strengthen Conceptual Understanding in Elementary Mathematics* – (Dewanti et al., 2024) .	Research and development (R&D) with limited trials, elementary school students	PBL + manipulative media strengthens understanding of mathematical concepts, makes it easier to understand abstract things, and trains critical thinking skills.

Innovation in Mathematics Learning Strategies in Elementary Schools

The use of innovative learning strategies that emphasize active student involvement in the mathematics learning process in elementary schools. One prominent approach is the GASING (Easy, Fun, Enjoyable) method based on traditional games studied by (Sariningsih et al., 2025) . The results of the study showed that the integration of GASING with the "mong-mongan" game was able to increase motivation and student learning outcomes. This finding is in line with the research of Putri & Sundi (2025) which revealed that the GASING method significantly strengthened the understanding of mathematical concepts in fourth-grade elementary school students. Situmorang et al (2024) also confirmed the effectiveness of GASING, where the post-test scores of second-grade students taught with this method were much higher than those of the control group. Furthermore, based on experiments conducted by Sihombing et al (2025) showed significant differences in the post-test scores of the experimental and control classes, thus proving that GASING is consistently effective in improving academic achievement.

In addition to the GASING method, the Team Games Tournament (TGT) learning model based on digital media is also attracting attention. Sariningsih et al (2025) found that TGT combined with *Articulate Storyline* software not only improves mathematics learning outcomes but also student interest. The use of interactive media in learning makes students more interested, active, and easier to understand abstract concepts. This is reinforced by Kurnia & Edwar, (2025) who stated that project-based learning strategies, problems, and the integration of digital technology are able to develop 21st-century skills such as critical thinking, collaboration, and creativity. Thus, the combination of cooperative models with digital media supports the creation of learning that is more meaningful and relevant to the needs of today's generation.

Integration of Technology and Local Context

The integration of technology into elementary school mathematics learning has proven effective in strengthening students' thinking and problem-solving skills. Jampel & Antara (2025) developed a collaborative Augmented Reality (AR)-based ethnomathematics framework for geometry learning. This quantitative study, with a pretest-posttest design, involved 30 fourth-grade students and demonstrated a significant improvement in problem-solving skills after the intervention. These results open up important opportunities for contextual and critical technology implementation in the classroom, as AR allows abstract material to be visualized in a concrete and engaging manner. Similarly, Veronika & Liliana (2025) suggest that a 21st-century mathematics curriculum needs to maximize the use of software such as *GeoGebra* to foster students' critical and creative thinking skills. The use of *GeoGebra* has been shown to improve conceptual understanding and mathematical reasoning through dynamic visual interactions, as well as building digital literacy from an early age.

Meanwhile, in another dimension which is no less important, as stated by Ayada & Tegeh, (2023) which examines the environment-based STAD cooperative learning model. In a quasi-experimental study with a nonequivalent post-test only control group design, 29 elementary school students in the experimental group and 25 in the control group showed that the STAD approach, contextualized according to the surrounding environment, significantly improved mathematics learning outcomes compared to conventional learning. This approach strengthens the relevance of learning to everyday life and increases student engagement.

Strengthening Conceptual Understanding and Thinking Skills

Mathematics learning strategies for elementary school students demonstrate a strong focus on improving conceptual understanding and critical thinking skills. One example is the research of Dewanti et al. (2024) who implemented *Problem-Based Learning* (PBL) with manipulative media such as Uno cards, paper origami, and play money to explore the concepts of area and volume. The results showed that this model significantly strengthened students' understanding of mathematical concepts. Students' scores on conceptual tests improved dramatically; group activities and discussions also supported the process of constructing deeper knowledge.

Meanwhile, Jampel & Antara's (2025) research integrated Augmented Reality (AR) into a collaborative framework based on ethnomathematics, specifically for geometry. The pretest–posttest research design on fourth-grade students showed a significant increase in problem-solving abilities after AR intervention. This method offers a contextual, collaborative learning approach, and utilizes technology ideally. Both concrete manipulative media strategies and digital technology demonstrate different but complementary strengths in shaping students' higher-order thinking skills. The PBL model with manipulatives brings mathematical abstractions closer to concrete forms that students can feel and manipulate. This supports visual-spatial learning and a deeper understanding of basic concepts. Meanwhile, AR brings concepts to an interactive digital dimension, enabling dynamic and collaborative exploration of geometric visualizations, while stimulating creativity, logic, and problem-solving through immersive experiences.

The Role of Collaboration in Mathematics Learning

Collaborative learning approaches have emerged as a common thread in a number of recent studies on mathematics learning strategies in elementary schools. The Team Games Tournament (TGT) model, as studied by Sekarsari & Rusnilawati (2023), utilizes competitive elements in small groups to strengthen interactions between students. This quasi-experimental intervention showed that students learning through TGT supported by the interactive media Articulate Storyline showed improvements in learning outcomes and

interest in mathematics, indicating that task-based collaboration and digital media can foster active engagement and shared understanding. Another equally important model is the environment-based STAD, studied by (Ayada & Tegeh, 2023) **.** In this approach, students work in heterogeneous teams to correct each other's learning outcomes. The results of the study indicate that this cooperative learning model not only improves academic achievement but also strengthens social interactions as students learn to provide feedback, support their groupmates, and relate mathematics material to their environmental context.

Implications of Research on Learning Practices

The results of the synthesis of the five articles provide important implications for mathematics learning practices in elementary schools, particularly in the 21st-century era of education that demands innovation, active student involvement, and technology integration. First, teachers need to adopt innovative learning strategies that combine traditional approaches with digital technology. For example, research by Sariningsih et al., (2025) who developed the GASING method based on traditional games showed that the use of local cultural elements can increase students' motivation and understanding of mathematical concepts. On the other hand, research by Sekarsari & Rusnilawati (2023) showed that the implementation of *the Team Games Tournament* (TGT) model assisted by the digital media Articulate Storyline was effective in improving learning outcomes and student interest in mathematics. This proves that the integration of traditional and digital can create a more varied and enjoyable learning experience.

Mathematics learning needs to be designed based on real-life contexts to be more relevant to students' lives. Ayada & Tegeh (2023) emphasize the effectiveness of environment-based STAD, which not only improves learning outcomes but also connects mathematical concepts to everyday experiences. This relevance is important because contextual learning can help students understand the direct benefits of mathematics in life, while simultaneously reducing achievement gaps between individuals. Collaboration needs to be placed at the core of the learning process. Jampel & Antara, (2025) Through the integration of ethnomathematics with Augmented Reality (AR), it was shown that digital collaboration can improve students' problem-solving abilities, especially in geometry. In addition, Dewanti et al., (2024) demonstrated that problem-based learning (PBL) using manipulative media can also strengthen critical thinking skills through group discussions. Thus, collaboration not only deepens conceptual understanding but also fosters social skills essential for student development.

Conclusion

Based on the results of a study of five empirical articles that have been analyzed, it can be concluded that mathematics learning strategies in elementary schools in the past five years have shown a strong tendency towards innovative, contextual, collaborative, and technology-based approaches. Local culture-based learning strategies such as the GASING method with traditional games have been proven to increase students' motivation and understanding of mathematical concepts, while making learning more enjoyable. The integration of digital technologies such as *Articulate Storyline* and *Augmented Reality* (AR) is not only effective in improving learning outcomes and student interest, but also strengthens critical thinking and problem-solving skills that are required for 21st-century competencies.

Learning contextualized within real-world environments and local cultures significantly contributes to connecting mathematical concepts to everyday life, making it easier for students to understand the practical benefits of mathematics. Fourth, collaboration consistently emerges as a crucial element in various strategies, both through cooperative models such as

STAD and TGT and through collaborative digital frameworks based on ethnomathematics. Collaboration not only strengthens conceptual understanding but also develops social skills such as communication, empathy, and cooperation, which support long-term academic success. Therefore, the direction of developing mathematics learning strategies in elementary schools should emphasize a combination of concrete and digital media, the integration of real-world contexts, and the application of collaborative learning. This approach has the potential to narrow the achievement gap between students, strengthen numeracy literacy, and comprehensively improve the quality of mathematics learning at the elementary level.

References

Ayada, IM, & Tegeh, IM (2023). Environmentally Based STAD Type Cooperative Learning Model Improves Mathematics Learning Outcomes. *Elementary School Science Journal, 7* (4), 722–729. https://doi.org/10.23887/jisd.v7i4.60873

Barokah, N., & Mahmudah, U. (2025). Transforming Elementary School Mathematics Learning Through Deep Learning: Strategies to Improve Motivation and Achievement. *Numbers: Scientific Journal of Mathematics, Earth and Space, 3* (3), 48–61. https://doi.org/10.62383/bilangan.v3i3.521

Dewanti, SS, Rahmawati, & Sumardi. (2024). Problem-Based Learning with Manipulative Media: Enhancing Elementary Students' Conceptual Understanding in Area and Volume. *Elementary School Scientific Journal, 8* (3), 487–499. https://doi.org/10.23887/jisd.v8i3.80221

Dores, OJ, Wibowo, DC, & Susanti, S. (2020). Analysis of Students' Critical Thinking Skills in Mathematics. *Scaffolding: Journal of Islamic Education and Multiculturalism, 2* (2), 321–332. https://doi.org/10.37680/scaffolding.v4i1.1331

Hidayati, N., Mulyasari, E., Hendriawan, D., & Nuryani, RF (2025). 21st Century Mathematics Curriculum in Elementary Education: A Systematic Literature Review of Critical Thinking and Creativity Skills. *Kalam Cendekia: Scientific Journal of Education, 13* (02), 788–801.

Jampel, IN, & Antara, IGWS (2025). Ethnomathematics-Collaborative Augmented Reality: An Innovative Framework to Enhance Problem-Solving Skills in Elementary Geometry. *Elementary School Science Journal, 8* (3), 522–528. https://doi.org/10.23887/jisd.v8i3.85666

Jannah, R., Soraya, RA, Suriansyah, A., & Cinantya, C. (2024). Critical Thinking Skills in Mathematics Learning on Learning Outcomes in Elementary Schools. *MARAS: Multidisciplinary Research Journal, 2* (4), 1991–1998. https://doi.org/10.60126/maras.v2i4.550

Kharismayanda, M., Ketaren, MA, Rahmawati, S., Nabilla, Rahmadani, PS, Fadhilah, NA, & Wenni, S. (2025). Effective Strategies in Improving Elementary School Students' Understanding of Basic Mathematical Concepts. *Indonesian Journal of Educational Science Research, 2* (2023), 1080–1085. https://jpion.org/index.php/jpi1080Journal Website: https://jpion.org/index.php/jpi

Kurnia, L., & Edwar, A. (2025). Innovation in 21st Century Mathematics Learning Models: A Literature Review. *Pendas: Scientific Journal of Elementary Education, 10* (02), 58–66. https://doi.org/https://doi.org/10.23969/jp.v10i02.26910

Ladisya, N., Adillah, A., Putri, GI, Lathifa, K., Wulandari, L., Antosa, Z., & Sandy, R. (2025). Implementation of Project-Based Learning to Improve Mathematics Learning Outcomes on Cube Volume. *Jurnal Kiprah Pendidikan, 4* (3), 225–231. https://doi.org/https://doi.org/10.33578/kpd.v4i3.p225-231

Mangundap, JM, Koten, MS, Walewangko, SA, Patrisia, H., & Bulalong, RR (2025). The Effectiveness of Realistic Mathematics Education (RME) in Improving Motivation and Learning Outcomes of Second Grade Elementary School Students. *MARAS: Multidisciplinary Research Journal, 3* (3), 940–950.

https://doi.org/10.60126/maras.v3i3.1131

Muhdantiar, W., & Kasriman. (2025). The Effect of the PBL Learning Model Assisted by Phet Media in Mathematics Learning on Student Learning Outcomes. *Mathematic Education Journal, 13* (1), 183–196. http://journal.ipts.ac.id/index.php/MathEdu/article/view/3103

Pasaribu, F., Ammy, PM, Nasution, S., & Halomoan, T. (2025). Implementation of Problem-Based Learning Model to Improve Students' Understanding of Mathematical Concepts. *JMES (Jurnal Mathematics Education Sigma), 6* (1), 54–60. https://jurnal.umsu.ac.id/index.php/jmes/article/view/19760

Purwoko, RY (2025). In-depth learning oriented towards improving elementary school students' numeracy skills. *Jurnal Pendidikan Surya Edukasi (JPSE), 11* (1), 13–26. https://doi.org/https://doi.org/10.37729/jpse.v11i1.6479

Putri, DS, & Sundi, VH (2025). The Effect of the Gasing Mathematics Method (Easy, Fun, and Enjoyable) on the Understanding of Mathematical Concepts of Fourth Grade Elementary School Students. *Pendas: Scientific Journal of Elementary Education, 10* (2), 146–157. https://doi.org/https://doi.org/10.23969/jp.v10i02.24287

Rahmiyati, Hamsiah, A., & Rahmaniah, R. (2025). The Effectiveness of the Discovery Learning Model in Improving the Interest and Learning Outcomes of Fifth Grade Students at SD Inpres Tello Baru I/2 Makassar. *Bosowa Journal of Education, 5* (2), 229–234. https://doi.org/10.35965/bje.v5i2.5308

Saputra, H. (2024). The Development of Mathematical Thinking in Elementary School Children. *JEMARI: Journal of Elementary School Education, 6* (2), 53–64.

Sariningsih, KR, Parmiti, DP, & Yudiana, IKE (2025). The Gasing Method with the Traditional Game-Based Mong-Mongan Approach on the Mathematics Learning Outcomes of Third Grade Elementary School Students. *Elementary School Science Journal, 9* (2), 400–407. https://doi.org/10.23887/jisd.v9i2.96608

Sekarsari, EP, & Rusnilawati, R. (2023). The Effect of Team Games Tournament Model-Assisted Articulate Storyline Media on Improving Outcomes and Interest in Learning Javanese Script Material in Elementary School. *Elementary School Pulpit, 10* (1), 281–296. https://doi.org/10.53400/mimbar-sd.v10i1.55262

Sihombing, E., Widiyarti, G., & Daliani, M. (2025). The Effect of the Gasing Method on Mathematics Learning Outcomes of Fifth Grade Students of Elementary School 066044 Helvetia, Academic Year 2024/2025. *Education, Science, Social and Law, 4,* 1–7.

Situmorang, RG, Sirait, AP, Mailani, E., Winara, & Siregar, WM (2024). The Effect of the Gasing Mathematics Learning Method on Student Learning Outcomes in Addition Material in Grade II of Elementary School. *Journal of Elementary School Innovation, 1* (5), 1–5.

Veronika, S., & Liliana, S. (2025). Analysis of the Role of Technology in Mathematics Learning Based on Teacher and Student Perspectives. *Jurnal Cendekia: Journal of Mathematics Education, 9* (2), 976–985. https://doi.org/10.31004/cendekia.v9i2.4156

Widad, HD, & Hadi, MS (2025). Realistic Mathematics Education, Problem-Solving Ability, and Mathematics Learning in Elementary Schools. *JIIP - Scientific Journal of Educational Sciences, 8* (2), 2309–2315. https://doi.org/10.54371/jiip.v8i2.7146

Witono, S., & Hadi, MS (2025). Numeracy and Creative Thinking Skills in Mathematics Learning in Elementary Schools. *JIIP - Scientific Journal of Educational Sciences, 8* (3), 2489–2496. https://doi.org/10.54371/jiip.v8i3.7180