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Evaluating the Effectiveness, Challenges, and Contextual Applications of the Gasing Mathematics Method in Indonesia : A Systematic Literature Review

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ABSTRACT

This study examined the effectiveness, challenges, and contextual applications of the Gasing Mathematics Method in mathematics education through a systematic literature review. The study addressed the need for synthesized evidence on how the method influenced students' conceptual understanding and how it was implemented across formal and nonformal educational settings in Indonesia. A systematic review design was employed using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses framework. Thirty-five eligible articles published between 2014 and 2024 were selected from Scopus, Google Scholar, and ResearchGate based on predefined inclusion and exclusion criteria. The analysis showed that the Gasing Mathematics Method improved students' mastery of basic mathematical operations, increased learning engagement and motivation, and supported instructional access in rural and underserved areas. At the same time, the review identified several methodological limitations in the existing studies, including selection bias, small sample sizes, lack of control groups, and observer bias. The findings indicated that the Gasing Mathematics Method had strong pedagogical potential in mathematics education, particularly in contexts requiring accessible and practice-oriented approaches. However, the available evidence remained limited in terms of long-term evaluation and cross-contextual applicability. Overall, the study concluded that further empirical research was needed to examine the long-term effectiveness, digital integration, and adaptability of the method across diverse educational contexts.

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1. INTRODUCTION

A Systematic Literature Review (SLR) on the Gasing Mathematics Method is crucial for advancing research and improving mathematics education. As the volume of scientific research grows exponentially, systematic reviews have become essential tools to synthesize existing knowledge, identify research gaps, and ensure the credibility of conclusions drawn from existing studies (García-Peñalvo, 2022). This is especially relevant in the context of the Gasing Mathematics Method. The Gasing Method has recently gained recognition, particularly due to training programs held across Indonesia. Gasing Academy has successfully conducted training and dissemination of the Gasing Method in more than 110 cities/regencies across Indonesia since 2022. Over 11,000 teachers and 13,700 students have already understood and benefited from the Gasing Method (Gasing Academy, 2025).

Mathematics is often perceived as an uninteresting and difficult subject for students. Mathematics education faces various challenges. These challenges stem from both students and educators. On the students' side, cognitive issues include poor mastery of basic concepts, difficulties in abstract thinking, and confusion when solving similar problems that actually reflect real-life situations (Lestari et al., 2021; Lima et al., 2019). Additionally, affective issues such as math anxiety, low interest and engagement, and lack of confidence in the learning process further hinder academic achievement (Aruvee & Vintere, 2023; Demedts et al., 2022; Verdeflor et al., 2024).

On the educators' side, problems include the use of monotonous teaching methods, limited adaptability to students' learning styles, and a lack of innovation and mastery in applying contextual and meaningful teaching approaches (Nilsson & Pareto, 2010; Yong et al., 2018). The Gasing Method emerges as one approach to address these issues. It is a relatively new method developed to simplify, make enjoyable, and make mathematics education more accessible to students in Indonesia. By conducting an SLR, researchers can evaluate how this method compares to other educational strategies and assess its potential to improve mathematics learning outcomes.

The Gasing Method emphasizes the development of conceptual understanding and fluency in key areas such as addition, multiplication, and division. The method provides a clear and structured progression for mastering mathematical operations, focusing on both concrete and abstract thinking (Hendriana et al., 2019). It has proven effective in improving mathematical understanding, especially in rural, remote, underdeveloped, and underserved communities (Prahmana & Suwasti, 2014). These findings highlight the Gasing Method's strength as an inclusive teaching approach. This method is gaining further attention for its ability to engage students, enhance problem-solving skills, and increase motivation to learn mathematics, factors essential for building a strong foundation in mathematical competency (Janardhanan & Charles, 2024).

The Gasing Method shows promising results in improving the quality of education and students' learning experiences compared to traditional teaching methods. It integrates innovative methodologies, such as active and sequential learning strategies that progress from concrete to abstract thinking and mental calculation. The Gasing Method holds potential to bridge achievement gaps among students and foster deeper understanding of mathematical concepts (Canto López et al., 2022). By focusing on key aspects of mathematical operations and making learning enjoyable and engaging, it has received positive feedback from both students and teachers (Siregar et al., 2014). This method also aligns with broader trends in mathematics education that aim to develop critical thinking, creativity, and problem-solving abilities among students. However, challenges remain in implementing this

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method on a larger scale, including the need for professional development for teachers and the creation of appropriate curriculum resources (Janardhanan & Charles, 2024).

Furthermore, an SLR on the Gasing Method provides valuable insights for curriculum development. Educators and policymakers can assess how this method can be integrated into existing curricula, ensuring it supports both local and national educational goals across formal and non-formal education settings. By evaluating the method's effectiveness across diverse contexts, this review can inform the design of inclusive and adaptive curricula that meet the needs of various student groups. Conducting SLR in the field of mathematics education, particularly one focused on the Gasing Method, inevitably presents several challenges.

These include issues related to search strategies, data extraction, and inclusion/exclusion criteria. Furthermore, the rapidly evolving nature of educational research necessitates continuous updates to systematic reviews to remain relevant and reflect the latest developments in the field (Imtiaz et al., 2013). Despite these challenges, the SLR methodology remains an invaluable tool for synthesizing knowledge, offering a comprehensive understanding of the contributions of the Gasing Mathematics Method, and guiding future research and practice.

Accordingly, this study sought to provide a systematic synthesis of the literature on the Gasing Mathematics Method in order to evaluate its effectiveness, identify major implementation challenges, examine the educational contexts and participant groups in which it has been applied, and assess its contribution to teacher and tutor competence as well as curriculum development. By integrating the available evidence, this study aimed to clarify the current state of knowledge on the method and provide a stronger basis for future research, instructional practice, and educational policy. In this way, the review was expected to contribute not only to a better understanding of the pedagogical potential and limitations of the Gasing Method, but also to broader efforts to improve the quality, inclusiveness, and responsiveness of mathematics education in Indonesia.

2. METHOD

2.1 Research Design

This study employed a Systematic Literature Review design to synthesize existing evidence on the Gasing Mathematics Method in mathematics education. A systematic review was considered appropriate because it enables a structured, transparent, and replicable process for identifying, screening, and analyzing relevant studies. To ensure methodological rigor, the review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses framework, which provides standardized guidance for reporting review procedures and study selection processes. The use of this framework helped organize the review into clear stages, including identification, screening, eligibility assessment, and final inclusion of studies for analysis (Chotisarn & Phuthong, 2025; Page et al., 2021).

The literature search was conducted using the keywords Matematika, Metode Gasing, Hasil Belajar, Math, Mathematics, Gasing Math, and Gasing Method. These search terms were selected to capture both Indonesian- and English-language studies related to the implementation of the Gasing Mathematics Method. The search process identified a total of 259 records from three main sources, namely Google Scholar, ResearchGate, and Scopus. Google Scholar contributed the largest number of records, followed by ResearchGate and Scopus. The complete selection process is presented in Figure 1.

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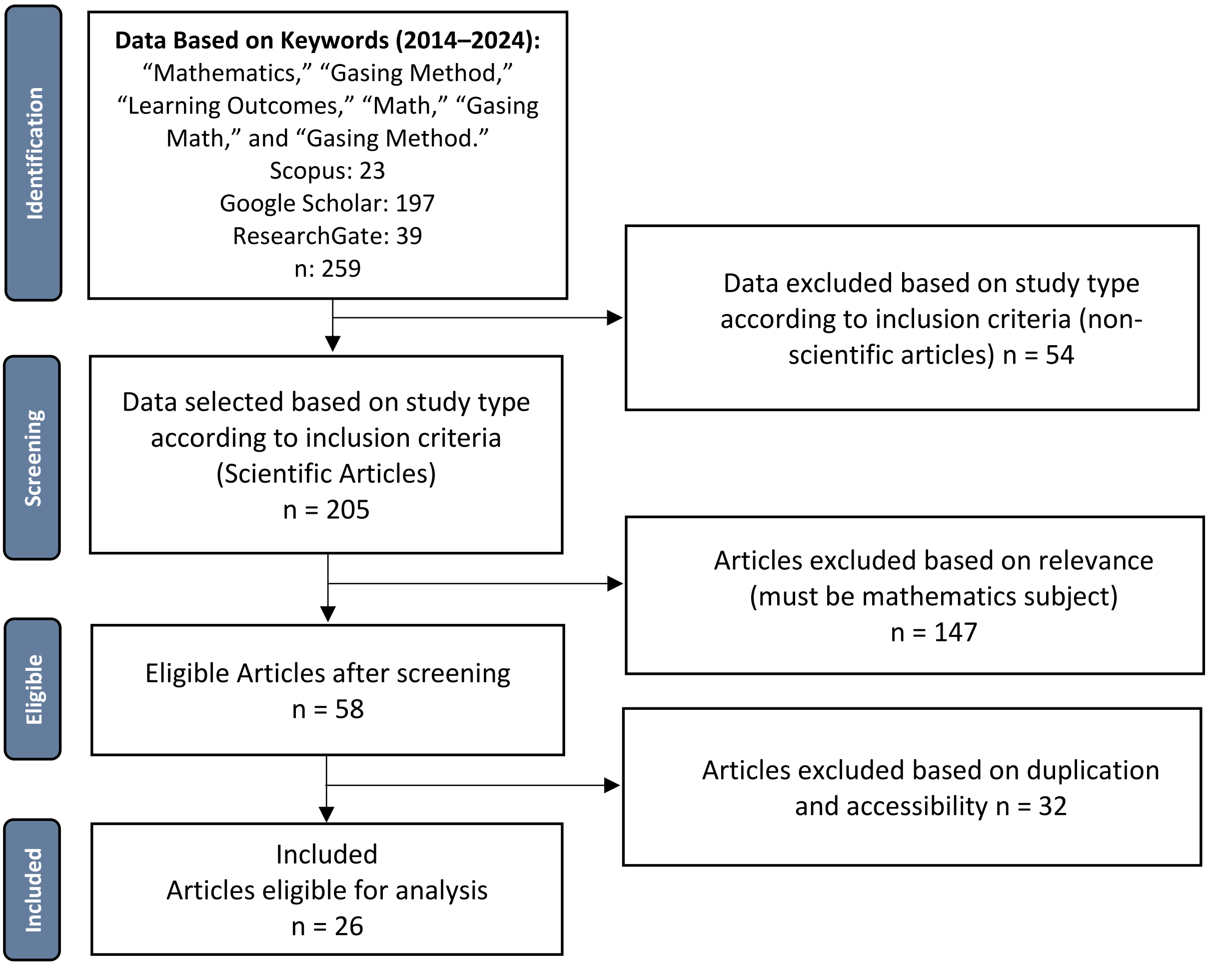

Figure 1. PRISMA Flow Diagram

2.2 Inclusion and Exclusion Criteria

The review applied explicit inclusion and exclusion criteria to ensure the relevance and quality of the selected studies. The inclusion criteria were as follows: the studies had to be published between 2014 and 2024; written in either English or Indonesian; focused on the Gasing Method in relation to mathematics learning; available in open-access form; and indexed in Scopus or in SINTA with a minimum classification of SINTA 5. These criteria were intended to ensure that the review included studies of sufficient academic relevance and accessibility while maintaining a clear topical focus (Rullyana et al., 2024).

The screening stage reduced the initial pool of 259 records to 205 articles after excluding 54 records that did not meet the inclusion criteria, particularly in relation to publication type and relevance. The eligibility assessment was then conducted on the remaining 205 studies through a closer examination of topical relevance and methodological appropriateness. At this stage, 147 articles were excluded because they were not sufficiently related to mathematics or the Gasing Method, or because the full texts were not accessible. This process resulted in 58 articles that met the eligibility criteria for further assessment. In the final stage, duplicate records and inaccessible articles were removed, leading to the exclusion of 33 additional records. As a result, 25 articles were included in the final review and analyzed in depth. This multi-stage process reflects the selective and transparent application of the review criteria, which is essential for producing a reliable and focused synthesis of the literature (Moher et al., 2009; Page et al., 2021; Shamseer et al., 2015).

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2.3 Data Extraction and Analysis

After the final selection stage, data were extracted systematically from the 25 eligible articles. The extraction process focused on key aspects relevant to the objectives of the review, including publication characteristics, educational context, participant groups, research design, reported outcomes, implementation challenges, and the broader contribution of the Gasing Mathematics Method to mathematics education. This procedure enabled the researchers to organize the evidence into meaningful categories and to compare findings across different studies and contexts.

The analysis was conducted descriptively and thematically. First, the selected studies were mapped according to their general characteristics, including year of publication, context of implementation, and target participants. Second, the substantive findings of the articles were examined to identify recurring patterns concerning the effectiveness of the Gasing Method, its pedagogical strengths, implementation barriers, and its relevance for teachers, tutors, and curriculum development. This approach made it possible to synthesize the evidence in a coherent manner while preserving the diversity of educational settings represented in the literature. The final selection of 25 studies, representing 9.65% of the initially identified records, indicates a relatively high level of selectivity, which is consistent with the standards of rigorous systematic review methodology in educational research. Such rigor is essential for ensuring the reliability and validity of the review findings and for providing a credible basis for future research and practice (Higgins et al., 2020; Page et al., 2021).

3. RESULT AND DISCUSSION

3.1 Result

The systematic search and screening process across Scopus, Google Scholar, and ResearchGate using predefined inclusion and exclusion criteria resulted in 25 eligible articles for analysis. A comprehensive reading revealed that the majority of studies employed quantitative designs (mostly quasi-experimental and pre-experimental) to assess the effectiveness of the Gasing Method. These studies typically measured outcomes such as mathematics performance, student engagement, and conceptual understanding. Most studies focused on primary and secondary school students in both formal education (school-based) and non-formal education (community learning centers, after-school programs). This context was especially prominent in rural areas, where access to quality mathematics education is often limited (Hendriana et al., 2019).

The Gasing Mathematics Method has proven effective in improving students' conceptual understanding and mathematical achievement. Various studies show that students who participate in learning with the Gasing Method experience significant improvements in their learning outcomes. For example, in a study conducted at SDI Sikumana 2 in Kupang, students who used the Gasing method achieved higher average post-test scores compared to those who used conventional teaching methods (Amtiran et al., 2024). This finding is supported by improvements in students' understanding of multiplication and division, which led to better post-test results, indicating that GASING is effective in strengthening students' mathematical understanding, especially in foundational concepts that are often perceived as difficult.

However, despite its effectiveness, the implementation of Gasing faces several challenges. One major challenge is the lack of teaching readiness in some schools, where teachers are still accustomed to traditional methods that focus more on lecturing (Kusuma et al., 2019). Additionally, students often encounter initial difficulties in adapting to a more interactive approach, especially with more complex topics such as fractions and multiplying

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integers (Fitri et al., 2023). There is also student resistance to the new method, which requires time to build trust in techniques that are more enjoyable and game-based.

The training for the Gasing Mathematics Method is primarily aimed at elementary school teachers, particularly those teaching grades 3 to 6. The goal of the training is to help teachers implement this method effectively in teaching mathematics, with an emphasis on concepts that are easy for students to understand through concrete media and visual exploration (Halyadi et al., 2016). In addition, elementary school students are the primary target for this method's application, focusing on teaching basic topics such as addition, subtraction, and multiplication (Amtiran et al., 2024). Through training that focuses on the use of concrete teaching aids and step-by-step learning, teachers can develop more effective and engaging teaching skills (Kusuma et al., 2019).

The application of the Gasing Method is not limited to formal education but has also been implemented in non-formal education, such as training for out-of-school students, which showed similar results in improving their numeracy skills (Halyadi et al., 2016). Further research on the application of GASING in non-formal education, such as in community centers or out-of-school education institutions, also demonstrates significant improvement in students' numeracy skills, as seen in the Pasar Bersama RT 001 community in Sorong, which proves that GASING is effective not only in formal schools but also outside of them (Afifasani et al., 2025).

GASING can be integrated into the national curriculum by adapting its core principles, which prioritize concept-based learning, where mathematics education starts with concrete examples and gradually moves to more abstract concepts (Halyadi et al., 2016). At the local level, this integration can be done by organizing simpler materials first before moving on to more complex ones, ensuring that students' conceptual understanding develops well. With this approach, it is expected to improve educational outcomes, especially in teaching basic mathematics. Regarding research gaps, there is a lack of long-term research on the impact of GASING on mastering more complex topics, such as those encountered by middle school students. Further studies are needed to test the application of the Gasing Method on more complex materials and to develop digital applications dan guide book that can support its wider implementation, both in formal and non-formal schools.

Overall, the Gasing Mathematics Method has proven effective in improving students' understanding of mathematics, developing teachers' pedagogical skills, and can be applied in various educational contexts. Broader implementation in both formal and non-formal education, along with further developments in digitalization, could open up the potential of GASING to enhance educational outcomes comprehensively. Further research is necessary to address existing research gaps and to maximize the potential of GASING in mathematics education across various educational levels.

Several categories of bias were identified in the systematic literature review (SLR) on the Gasing Method. The following biases were found and may serve as references for future studies. First, selection bias is evident in non-equivalent control group quasi-experimental designs, such as the study by Munawaroh & Nurtamam (2024), which compared treatment and control groups without randomization. Without randomization, baseline characteristics between groups may differ systematically, making it difficult to confirm whether observed changes are due solely to the Gasing Method. Shadish et al. (2002) emphasized that in quasi-experiments, non-random allocation introduces confounds that must be identified and controlled individually to support causal inference.

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Second, small sample sizes, such as in Prahmana (2015) study with only 11 participants, raise the potential for sampling bias due to the lack of population representation. Babbie (2014) noted that sampling error increases as sample size decreases, especially in non-probabilistic sampling frames, reducing the reliability and external validity of findings and weakening generalizability. Third, some Gasing Method studies such as Prahmana & Suwasti (2014) involved researchers acting as both facilitators and evaluators, increasing the risk of performance and observer bias. Without adequate blinding, both participants and researchers can be influenced by their awareness of treatment status, potentially affecting intervention delivery and outcome assessments (Hróbjartsson et al., 2012; Moustgaard et al., 2020). The Cochrane Handbook stresses the importance of blinding to minimize these biases across all domains of risk of bias assessment (Higgins et al., 2020).

Fourth, studies using one-group pretest–posttest designs without control groups, such as Khasanah et al. (2017), are at risk of testing and maturation effects. Shadish et al. (2002) argued that repeated measurements (pretest) may improve scores simply due to practice effects (testing bias), and natural changes over time (maturation bias) may account for score differences—independent of the intervention. Without an equivalent control group, it becomes difficult to isolate the intervention's effects from these internal validity threats.

Fifth, Dinata et al., (2016) used self-report instruments to measure motivation or understanding, introducing response bias, as respondents tend to provide socially desirable answers. Fowler (2014) emphasized that sensitive questions should be clearly designed to avoid ambiguity and minimize social pressure so that responses reflect true attitudes rather than perceived expectations of the researcher. Despite these limitations in research design, the findings still offer valuable contributions to understanding the phenomenon under study.

3.2 Discussion

Based on the findings from the analyzed articles, the GASING method has proven effective in improving conceptual understanding in mathematics and enhancing teachers' instructional skills. For instance, the study by Siregar et al. (2014) demonstrated that the GASING method significantly increased students' mastery of addition concepts and positively influenced teachers' ability to teach those concepts. This aligns with behaviorist theory, which emphasizes repetition and reinforcement to achieve mastery of basic concepts. Prahmana & Suwasti (2014) also supported this finding, showing that GASING helped prospective teachers in rural areas transition from concrete to abstract understanding, particularly in division concepts. This illustrates how GASING can help strengthen conceptual understanding, especially in regions with limited access to quality education.

Additionally, a study by Kusuma & Sulistiawati (2014) showed that GASING helped first-year university students better understand and teach multiplication, indicating its effectiveness in enhancing both student comprehension and teaching competence. Another study by Dinata et al. (2016) extended the application of GASING, demonstrating increased motivation and mastery of physics among high school students. These findings suggest that the GASING method is effective not only in mathematics but also in other subjects, enhancing its versatility across disciplines.

The research by Armianti et al. (2016) also provided evidence that GASING improves students' understanding of multiplication and geometry, albeit with a limited sample. Then, The study by Khasanah et al. (2017), which combined GASING with mobile games, found that this approach enhanced students' problem-solving skills at the secondary school level, indicating the potential of integrating GASING with technology to support learning. Next,

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Findings from Maulida et al. (2024) revealed that combining GASING with the TGT (Team Game Tournament) learning model was effective in improving students' understanding of multiplication, showing that GASING performs well in collaborative learning environments.

The Gasing Mathematics Method has proven to be highly effective for primary and secondary school students, especially in rural or underprivileged areas. The research by (Hendriana et al., 2019) explicitly proves the effectiveness of the GASING method for rural students in Indonesia, showing that students from rural backgrounds in Serui, Ambon, and South Sorong are able to understand mathematical concepts more quickly and demonstrate high enthusiasm in learning. These students often lack access to quality mathematics education, and the Gasing method offers a structured and engaging way to bridge that gap. Its ability to simplify complex mathematical concepts and make learning interactive helps students build a strong foundation in mathematics, which is essential for success in more advanced levels of the subject.

The Gasing method also offers significant benefits for teachers, particularly in enhancing their pedagogical competence. Studies such as Siregar et al. (2014) and Prahmana & Suwasti (2014) found that when teachers are well-trained in the Gasing method, they feel more confident and capable of engaging students. This shows that teacher training plays a crucial role in the success of this method, and ensuring that teachers are equipped with the necessary skills to implement it is of great importance.

However, most studies highlight limitations such as small sample sizes, lack of control groups, and context-specific findings. Therefore, future research should consider using larger samples, incorporating control groups, and exploring diverse contexts to test the generalizability of these findings. Additionally, the integration of modern technologies, such as mobile games and digital platforms, may further enhance the effectiveness and engagement of GASING in various educational settings, both formal and non-formal.

Despite its effectiveness, implementing the GASING Mathematics Method comes with challenges. First, teacher training emerges as a crucial barrier to successful implementation. Many teachers report the need for more targeted professional development to fully understand how to apply the method in their classrooms. As noted by Siregar et al. (2014) and Hendriana et al. (2019), inadequately trained teachers often struggle to engage students and facilitate active learning, which are essential components of the method's success.

Another challenge is the inconsistent application of the GASING method across classrooms. Without a standardized framework, teachers interpret and apply the method differently, leading to variability in student outcomes. This inconsistency underscores the need for the development of more standardized instructional protocols to ensure that all students benefit equally from the method.

The effectiveness of the GASING mathematics method has been empirically examined in diverse participant groups, including 169 elementary students comprising 31 fourth graders (Armianti et al., 2016), 27 experimental and 26 control fourth graders (Kurniawan & Latifatunnisa, 2024), 20 experimental and 10 control fourth graders (Munawaroh & Nurtamam, 2024), 10 third graders (Hidayah et al., 2024), 24 elementary students in both control and experimental groups (Halyadi et al., 2016), and 21 third graders (Fitri et al., 2023). Then, 124 secondary students comprising 60 seventh graders (Khasanah et al., 2017), 22 ninth graders (Dinata et al., 2016), and 42 eleventh graders (Ikbal et al., 2021). Besides, The study involved 153 teachers, comprising a total of 53 pre-service teachers (Armianti et al., 2016; Hendriana et al., 2019; Prahmana, 2015) and 35 in-service elementary school teachers (Mulyawati & Sarwinda, 2021).

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Tabel 1. GASING Target Audience

Category	Age Range	Number of Participants	Number of Studies
Elementary Students (Grade III–IV)	8-10 years	169	6
In-service Teachers	25-55 years	35	1
Pre-service Teachers	18-22 years	53	4
Secondary Students (Junior–Senior High)	12-17 years	124	3

Based on the comprehensive analysis of GASING research studies, empirical investigations have involved 381 participants across 14 studies conducted between 2014-2024. The distribution reveals a strategic focus on different educational levels, with elementary students (Grades III-IV) representing the largest cohort at 169 participants (44.4% of total), demonstrating the method's primary application at foundational mathematics education levels. Secondary students (Junior-Senior High) constitute the second-largest group with 124 participants (32.5%), indicating substantial implementation across middle and high school mathematics curricula. The research also encompasses 53 pre-service teachers (13.9%), reflecting efforts to integrate GASING methodology into teacher preparation programs, while 35 in-service teachers (9.2%) participated in professional development initiatives. This participant distribution underscores GASING's comprehensive approach to mathematics education reform, targeting both direct student instruction and educator capacity building across primary and secondary education levels, with particular emphasis on early mathematical concept development in elementary grades.

The GASING Mathematics Method has been proven to support the development of teachers' and tutors' competencies by providing a more systematic, gradual, and enjoyable teaching approach. This model emphasizes three stages of learning: concrete, abstract, and mental calculation which enable teachers to guide students to deeply understand mathematical concepts rather than merely memorizing formulas. In this way, teachers are able to design learning strategies that are more interactive, varied, and student-centered (Mutiara et al., 2024).

Furthermore, training and workshops on GASING have shown a significant contribution to teachers' pedagogical competencies. A study conducted with elementary school teachers at Muhammadiyah Schools in East Jakarta demonstrated that the GASING workshop improved teachers' understanding of basic arithmetic operations and their skills in delivering lessons in a more engaging way (Mulyawati & Sarwinda, 2021). GASING also requires teachers to be creative in using concrete media, games, and enjoyable activities, which in turn increase students' learning motivation (Kurniawan & Latifatunnisa, 2024). Other studies reveal that the implementation of GASING not only improves students' learning outcomes but also strengthens teachers' roles as innovative and reflective facilitators in classroom practices (Dinata et al., 2016). Therefore, mastering the GASING method helps teachers and tutors enhance their pedagogical skills based on conceptual understanding, logical reasoning, and better classroom management. This makes GASING a method that benefits both students and teachers' professional development.

The GASING Mathematics Method has been applied across formal, non-formal, and even community-based education contexts. In formal education, GASING has been widely used in elementary schools, especially in teaching arithmetic operations (addition, multiplication, division, fractions, and geometry concepts such as perimeter and area). Its application in

Plamongansari Elementary School in Semarang showed significant improvement in students' understanding of perimeter and area (Sary & Ristiana, 2019). At Muhammadiyah Junior High School 1 Banjarmasin, students taught with GASING demonstrated improved motivation and learning outcomes, reaching 100% classical mastery (Dinata et al., 2016). Similarly, in Junior High School 2 Bitung, the average mathematics achievement of students taught with GASING was higher (77.70) compared to the control class (53.15) (Rumajar et al., 2024). Research in Kampar also indicated that GASING effectively enhanced students' understanding of two-digit addition and multiplication (Aprijon, 2020).

At the higher education level, GASING has been applied in the matriculation program at STKIP Surya, helping undergraduate students better understand integer operations (Kusuma & Sulistiawati, 2014). Research in rural areas, such as Papua, Ambon, and Sorong Selatan, also confirmed GASING's effectiveness in improving students' understanding of division concepts (Prahmana & Suwasti, 2014). In non-formal education, GASING has been implemented through community service programs. For instance, a program at Pasar Bersama in Sorong successfully improved participants' numeracy skills with an N-Gain of 56% and received positive responses from learners (Afifasani et al., 2025). GASING has also been introduced in teacher and tutor workshops within communities, which enhanced their pedagogical skills (Mulyawati & Sarwinda, 2021). Overall, GASING has proven effective for a wide range of learners—from elementary and secondary school students to university students and community learners in non-formal settings. Documented results include improved academic achievement, numeracy skills, learning motivation, interest, and mathematical thinking abilities.

Training in the GASING Mathematics Method is highly relevant for non-formal education because of its flexibility, which allows it to be implemented outside formal schools, including in community centers, literacy hubs, and equivalency education programs. A study in Sorong demonstrated that GASING applied in a community-based program significantly improved participants' basic arithmetic skills and learning interest (Afifasani et al., 2025). Similarly, the application of GASING in SDN Inpres Skouw Mabo, Papua, helped address literacy and numeracy problems by creating a more interactive and enjoyable learning experience, which improved students' cognitive skills (Msiren et al., 2025).

Other studies further affirm GASING's relevance beyond school contexts. For example, a training program conducted by the University of Timor as part of community service activities raised participants' post-test average score to 86.5 and generated positive feedback (Hijriani & Simarmata, 2023). Moreover, its use in empowering prospective teachers and local communities in rural Papua and Maluku also proved effective in enhancing conceptual understanding of basic mathematics operations (Prahmana & Suwasti, 2014; Siregar et al., 2014). These findings confirm that GASING is not only effective in formal schools but also plays an important role in community empowerment through non-formal education. Training for community tutors and facilitators is essential to ensure broader implementation of GASING in community centers, literacy houses, math courses, and equivalency education programs.

The integration of the Gasing Mathematics Method (Gampang, Asyik, Menyenangkan-Simple, Fun, Enjoyable) into national and local curricula can support deep learning, which emphasizes profound conceptual understanding rather than mere memorization of formulas or procedures. This method prioritizes the simplification of mathematical material through a logical and explorative approach, beginning with concrete examples and gradually moving toward abstract concepts (Astuti & Wiyanti, 2024). Learning that starts with real and relevant

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aspects of students' lives encourages them to develop a deeper understanding, connecting theory with practice. This aligns with the principles of deep learning, which stress a more holistic and reflective comprehension of the material, beyond procedural skills.

By using the Gasing method, students not only learn how to solve problems but also understand why and how mathematical concepts are applied in everyday life. This approach enables students to develop deeper critical thinking, creativity, and problem-solving skills, which are at the core of deep learning (Prahmana & Suwasti, 2014). Moreover, learning that is based on teaching aids and direct experiences encourages students to be actively involved in the learning process, so they do not merely memorize but truly understand the concepts being taught and are able to connect them with prior knowledge they already possess (Sulistiawati, 2019). This fosters more meaningful and sustainable learning, in line with the primary goals of deep learning.

Through the integration of the Gasing method, students are expected to experience mathematics learning that is both enjoyable and profound, motivating them to continue learning and applying mathematics in broader and more relevant contexts. Given its proven effectiveness, the Gasing Mathematics Method should be integrated into both national and local curricula to improve mathematical fluency across various educational contexts. The method's structured approach to teaching basic mathematical operations makes it an ideal tool for improving student outcomes, especially in schools serving disadvantaged communities. Integration into the curriculum would ensure that all students, regardless of background, have access to this innovative teaching method.

According to data from the Official Website of the Gasing Academy (2025), since 2022, the Gasing Academy has successfully conducted over 110 training sessions across various cities and districts in Indonesia, reaching more than 11,000 teachers and 13,700 students. The goal is to introduce and disseminate the application of the Gasing Mathematics Method in formal education. This aligns with previous findings, such as those reported by Siregar et al. (2014) and Prahmana & Suwasti (2014), which showed that quality training in the Gasing Method can enhance teachers' confidence and their ability to engage students more effectively in the learning process. Despite these significant achievements, research gaps remain—particularly in evaluating the long-term impact of such training on teaching practices and student learning outcomes. Further research is needed not only to examine the short-term effectiveness of the method, but also to understand how its implementation endures over time and continues to improve students' mathematical understanding.

Moreover, although Gasing Academy (2025) has successfully conducted training in various regions, more focused research on teachers' and students' perceptions of the training is necessary to uncover the challenges and benefits they experience. This could help refine training strategies and ensure that the method is accepted and effectively implemented across diverse educational settings. Further studies are also needed to assess how far such training enhances teachers' pedagogical skills, which are critical for successful implementation of the Gasing Method. Considering the importance of teaching skills in optimizing the method's application, studies that measure teachers' pedagogical and andragogical competencies post-training would provide valuable insights into how well the training equips them with effective teaching strategies. Research findings demonstrate that teachers who participated in pedagogical training exhibited significant improvements in teaching skills, while andragogical approaches significantly influenced learning outcome competencies in training programs (Hasibuan et al., 2023; Rahaju, 2023).

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In line with 21st-century educational development, it is also important to assess how the Gasing Method contributes to the development of 8C skills (Critical Thinking, Creativity, Communication, Collaboration, Character, Citizenship, Computing, and Curiosity) among students. Research focusing on the development of these skills through the Gasing Method could provide a more holistic view of how this approach enhances not only mathematical understanding but also other essential life skills.

Finally, although Gasing training has been widely implemented in formal education settings, non-formal and informal education contexts, such as home-based learning by parents and community study groups, remain largely unexplored. Research investigating the application of the Gasing Method in these settings could open new opportunities for broader educational engagement and improved mathematical understanding beyond the classroom. With the advancement of educational technology, integrating the Gasing Method with digital tools is also a topic worthy of deeper exploration. Research into digital applications or learning platforms based on the Gasing Method could increase its effectiveness and reach, making it more relevant for future education systems that increasingly rely on technology.

To strengthen the validity and generalizability of findings regarding the Gasing Mathematics Method, future studies should adopt experimental designs with adequate sample sizes and appropriate control groups (Prahmana & Suwasti, 2014; Shadish et al., 2002). Diverse contexts, including trials in urban schools, as well as in non-formal and informal education such as home-based learning or community learning groups, can help reveal the effectiveness of the Gasing method across a broader student population (Yang & Cho, 2024).

Furthermore, the integration of modern technology through mobile games and digital platforms should be explored using adaptive research designs, such as group-based quasi-experimental pretest–posttest studies, to measure the impact of digital Gasing interventions on student engagement and learning outcomes (Hendriana et al., 2019; Khasanah et al., 2017). Research should also assess the impact of teacher training on pedagogical competence, using valid and reliable instruments and blinded assessors to evaluate instructional quality, thus minimizing performance and observer bias (Higgins et al., 2020; Hróbjartsson et al., 2012). To assess the Gasing Method's contribution to 21st-century skills, the development of 8C skills should be measured using standardized quantitative and qualitative instruments (Janardhanan & Charles, 2024). Finally, longitudinal studies evaluating the long-term impact of Gasing interventions will provide deeper insights into the sustainability of improvements in both mathematical understanding and teacher pedagogical skills following training.

4. CONCLUSION

This systematic literature review concludes that the Gasing Mathematics Method has shown strong potential to improve students' conceptual understanding of fundamental mathematical operations, particularly through its structured progression from concrete to abstract learning. The findings indicate that the method has been effective in increasing student engagement, motivation, and problem-solving ability, especially in rural, remote, and underserved contexts. At the same time, the review also reveals several important challenges, including the limited availability of long-term evidence, the uneven depth of implementation studies, and the lack of sufficient research on how the method influences teacher competence and diverse learning settings. In response to the main research focus, the review suggests that the Gasing Method is pedagogically promising, but its broader impact remains insufficiently documented across formal, non-formal, and informal educational

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environments. It also appears that the current literature has not yet fully addressed how the method can be sustained, adapted, and integrated into wider educational systems and contemporary learning demands.

Based on these findings, practical action is recommended for several stakeholders. Researchers are encouraged to conduct more rigorous and longitudinal studies to evaluate the long-term effectiveness of the Gasing Method, its impact on different student groups, and its contribution to teacher pedagogical development. Teacher educators and training providers are advised to design more systematic training models that not only introduce the method procedurally but also strengthen its pedagogical application in real classrooms. Schools and curriculum developers are advised to explore how the method can be integrated into mathematics instruction in ways that support both conceptual mastery and broader student competencies, including critical thinking, creativity, communication, collaboration, character, citizenship, computing, and curiosity. In addition, policymakers and educational technology developers are encouraged to support the development of digital and scalable forms of the Gasing Method so that it can be implemented more widely and effectively across diverse educational contexts. Through these efforts, the Gasing Method may continue to develop as an innovative and inclusive approach that contributes to reducing educational inequality and expanding access to meaningful mathematics learning.

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