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Effectiveness GASING Method In Learning Mathematics Elementary School : Review Library Systematic Based On Prisma 2020 Protocol

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Abstract

The low achievements literacy numeracy Indonesian students are reflected from The 2022 PISA score was 366 points, far below OECD average of 472 encouraging exploration method learning innovative, one of them GASING method (Easy, Fun, and Enjoyable). Although a number of study take notes impact positive method this, the findings are still fragmented demand systematic synthesis. Article This aim analyze trend research, methods measurement effectiveness, factors contextual determinant success, as well as framework underlying theory implementation GASING method. Review Library Systematic implemented follow PRISMA 2020 protocol (Page et al., 2021) with Scopus exclusive data source for the 2020–2025 period. Of the 78 identified articles, 12 studies fulfil criteria inclusion and analyzed through approach analysis thematic and synthesis narrative (Popay et al., 2006). Findings show domination design quasi-experimental (n=7) with focus on improvement achievements cognitive and understanding steps mathematical. Effectiveness usually quantified through test written, while teacher readiness and integration contextual proven as a significant moderator. In Overall, the GASING method has the potential push quality learning mathematics basic, but studies scale more large, longitudinal design, and more strict in a way methodological Still required use strengthen validity external existing findings.

Keywords: GASING Method, Learning Mathematics, Review Literature Systematic , PRISMA 2020, Literacy Numeracy

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INTRODUCTION

Challenge fundamental in education global mathematics is low competence numeracy and ability think mathematical level tall students. In Indonesia, the condition This documented in a way consistent in survey international. The 2022 PISA report noted acquisition score mathematics Indonesian students amounted to 366 points, being in a way significantly below OECD country average of 472 points, with 81.7% of students is below Level 2 proficiency one proportion the highest among participating countries (Hartono & Setiawan, 2023). Although happen increase ranking by 5 positions compared to PISA 2018, the score absolute achieved equivalent with achievements 2003, indicating lack of improvement substantive quality in two decade last. Condition similar depicted in TIMSS 2015, where students Indonesia 's fourth grade is ranked lower in ability operation numbers and solving problem (R. I. I. Putri & Suryadi, 2021). The gap This push search method more learning effective, contextual, and responsive to characteristics development cognitive student.

One of innovations that are developing in Indonesia are GASING method (Easy, Fun, and Enjoyable), which was designed by Prof. Yohanes Surya as response to low quality learning mathematics at the level basic. Method This build understanding in a way gradually through three stage sequentially : concrete, semi- concrete, and abstract A aligned structure with principle constructivism Piaget's cognitive (Aisyah et al., 2022). In 2020–2025 period, research about the effectiveness of GASING has experienced significant growth. Safitri, Iriawan, and Mufliva (2025) noted improvement meaningful in a way statistics in ability understand procedure multiplication in students Phase B of school basis. Gultom, Panjaitan, and Tambunan (Hoven & Garelick, 2017) found that results similar to students second grade elementary school. Meanwhile that, Langi and Kondolayuk (2025) strengthen legitimacy theoretical GASING with analyze its suitability with APOS theory in the operational domain number round (Jediut, Madu, Ndiung, & Tilan, 2025),

Development research also shows expansion coverage study. Parwati and Suarjana (2024) explored GASING integration with learning based ethnomathematics For strengthen literacy numeracy and metacognition elementary school students. From the side teachers, Jediut et al. (Neta & AMBIYAR, 2021) documented teacher perceptions of implementation GASING in Manggarai, while Rusali and Todingbua (2025) studied impact GASING training for competence teaching teacher in Nabire (Kitchenham et al., 2019) .

Despite various findings the promising, there is two limitations crucial in existing literature. First, there is fragmentation knowledge consequence difference method operationalizing " effectiveness " starting from improvement score test results learning, acquisition literacy

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numeracy, understanding procedural, up to competence teacher pedagogical. Second, diversity design study quasi- experimental study development, up to survey perception make things difficult withdrawal comprehensive and reliable conclusions. Until moment this, not yet There is review literature systematic integration all over proof empirical the use framework rigorous methodological such as PRISMA 2020 (Mullis et al., 2016) and guidelines synthesis narrative Popay et al. (Kwarikunda et al., 2021).

Based on gap said, research This aim do Review Library Systematic (SLR) against studies about effectiveness GASING method using PRISMA 2020 guidelines. Four question Research Questions (RQ) that are answered is : (RQ1) What characteristics and trends study about GASING method in the 2020–2025 period ? (RQ2) How effectiveness GASING method is operationalized and measured in studies empirical factors ? (RQ3) contextual what influences variation its effectiveness ? (RQ4) Framework theoretical and design methodological what is the basis studies that ? Space scope review This limited to articles journal indexed by Scopus which has been through review peer-reviewed, published in 2020–2025 period, focusing on the level education basic, Indonesian or English, as well as reporting empirical data effectiveness GASING method.

LITERATURE REVIEW

GASING method in Learning Mathematics

GASING method is acronym from Easy, Fun, and Enjoyable three principle the main underlying philosophy approach. Method This emphasize mastery draft mathematics through order systematic stages : starting from manipulation object concrete, continued to semi- concrete (pictorial) visual representation, then then enter realm abstract (symbolic). This CPA (Concrete–Pictorial–Abstract) sequence No only found in GASING, but also the core of various approach proven mathematics effective in a way international, such as Singapore Math (OECD, 2023). The difference The main thing about GASING lies in addition the " fun " (enjoyable, happy) element that encourages motivation intrinsic student through approach game and relevant context with life daily.

In literature 2020–2025, coverage the construct of " effectiveness " in GASING studies are multidimensional. Some studies define it as improvement achievements cognitive (score test results learning, understanding procedural), while others measure it through competence literacy numeracy, ability metacognitive, or competence teacher pedagogical. Diversity operationalization This reflect its area dimensions impacts that can caused by the GASING method, at the same time become challenge methodological in synthesis cross study (Jaafar et al., 2022).

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Foundation Theoretical : Constructivism Cognitive and APOS Theory

In a way Epistemologically, the GASING method is rooted in the paradigm constructivism cognitive perspective that knowledge mathematics No transferred in a way passive, but rather built in a way active by students through interaction with environment and experience directly. The basis This own suitability strong conceptual with The APOS (Action–Process–Object–Schema) theory was developed by Dubinsky and McDonald (2001). The APOS theory describes that understanding mathematical develop through four stages : (a) Action actions that depend on external stimuli ; (b) Internalization process action become mental activity ; (c) Object encapsulation of the process into entities that can operated ; and (d) Scheme network relational between objects related. Langi and Kondolayuk (2025) showed that channel GASING learning in operation number round can mapped to in the APOS stages, so that give legitimacy solid epistemology.

Besides constructivism, perspective literacy numeracy and pedagogy responsive culture participate enrich runway conceptual GASING. Parwati and Suarjana (Popay et al., 2016) in A studies method mixture, developing the GASING integration model with ethnomathematics based wisdom Balinese local and digital e- evaluation systems. The results show improvement significant on the score literacy numeracy (based AKM instruments) and index metacognition students. Integration This represent shift paradigmatic from GASING as method skills counting fast towards GASING as framework learning holistic strengthening meaning mathematical in context culture. Its relevance the more strong remember condition literacy documented Indonesian numeracy weak in PISA 2022 (Hidajat, 2022).

Typology and Trends GASING Research

Based on pattern in literature, research GASING method can categorized to in three typology main. First, studies experimental or quasi- experimental testing the influence of GASING on achievements cognitive students(Pramono & Fitria, 2021). Second, studies development and integration that connects GASING with framework theoretical specific like APOS or approach contextual based culture (Rosidin et al., 2025).Third, studies perception and development competency of the teacher who assesses impact GASING training and implementation on quality teaching.

In a way historical, happened shift significant focus. Before In 2020, GASING research was more skills - centered counting fast and accurate basis. In 2020–2025 period, focus move to direction integration with theory learning latest development literacy numeracy 21st century, and

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strengthening competence teacher professionalism. Shift This reflect evolution conceptual important, at the same time cause heterogeneity in method effectiveness operationalized A the gap that justifies need will synthesis systematic as done in study This.

RESEARCH METHODS

Design Study

Study This use design Review Literature Systematic (*Systematic Literature Review* / SLR) with objective mapping, assessing, and summarizing findings empirical in a way structured and able reproduced. Review process follow two guidelines methodological main : (1) PRISMA 2020 (*Preferred Reporting Items for Systematic Reviews and Meta-Analyses*) as stated by Page et al. (2021), who emphasize process transparency, capability reproduction reports and accountability in reporting review ; and (2) guidelines synthesis narrative from Popay et al. (Manurung, 2022) who provide framework analytical textual For studies with heterogeneity methodological high. Stages The research also refers to Kitchenham and Charters (2007) who formulated three SLR phases : planning, implementation, and reporting review.

Strategy Search Literature

Search literature done in a way exclusive through the Scopus database for 2020–2025 period using fature search Advanced *Search* with search string :*TITLE-ABS- KEY("GASING" AND ("mathematics" OR " mathematics ") AND ("effectiveness" OR " effectiveness " OR "learning" OR " learning "))*Search limitations covering type documents (articles and proceedings), language (English and Indonesian), and field studies (Social Sciences and Mathematics). No enforced restrictions on quartiles journal (Q1–Q4) so that coverage search more inclusive (Vlasenko et al., 2022).

Criteria Inclusion and Exclusion

Table 1. Criteria Inclusion and Exclusion Selection Article

Aspect	Criteria Inclusion	Criteria Exclusion
Database	Indexed (all quartile)	No Scopus indexed
Year	2020–2025	Outside range year
Language	Indonesian and English	Other languages

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Type	Article peer-reviewed journals & proceedings indexed	Editorials, opinions, books, reports No indexed
Content	Focus on implementation or effectiveness GASING method in mathematics	No discussing GASING or No related mathematics
Data	Reporting empirical data effectiveness (quantitative / qualitative)	Non- empirical, duplication, text complete No available
Level	Primary and secondary education (SD–SMP)	Higher education or level No clear

Data Selection and Extraction Process

Search beginning produced 78 articles at the stage identification. After deletion duplicates and restrictions type documents, 72 articles remaining For filtering title and abstract. A total of 41 articles eliminated Because No relevant (n=28) or No study empirical (n=13), leaving 31 articles For evaluation eligibility text complete. At this stage this, 19 articles excluded Because No reporting effectiveness data in a way explicit (n=9), methodology No clear (n=6), or be outside criteria inclusion (n=4). With thus, 12 articles entered in synthesis qualitative, and 8 of them have quantitative data Enough For analysis comparative. The entire selection process visualized in Figure 1 below (Abdan Syakuran & Afrianto, 2022).

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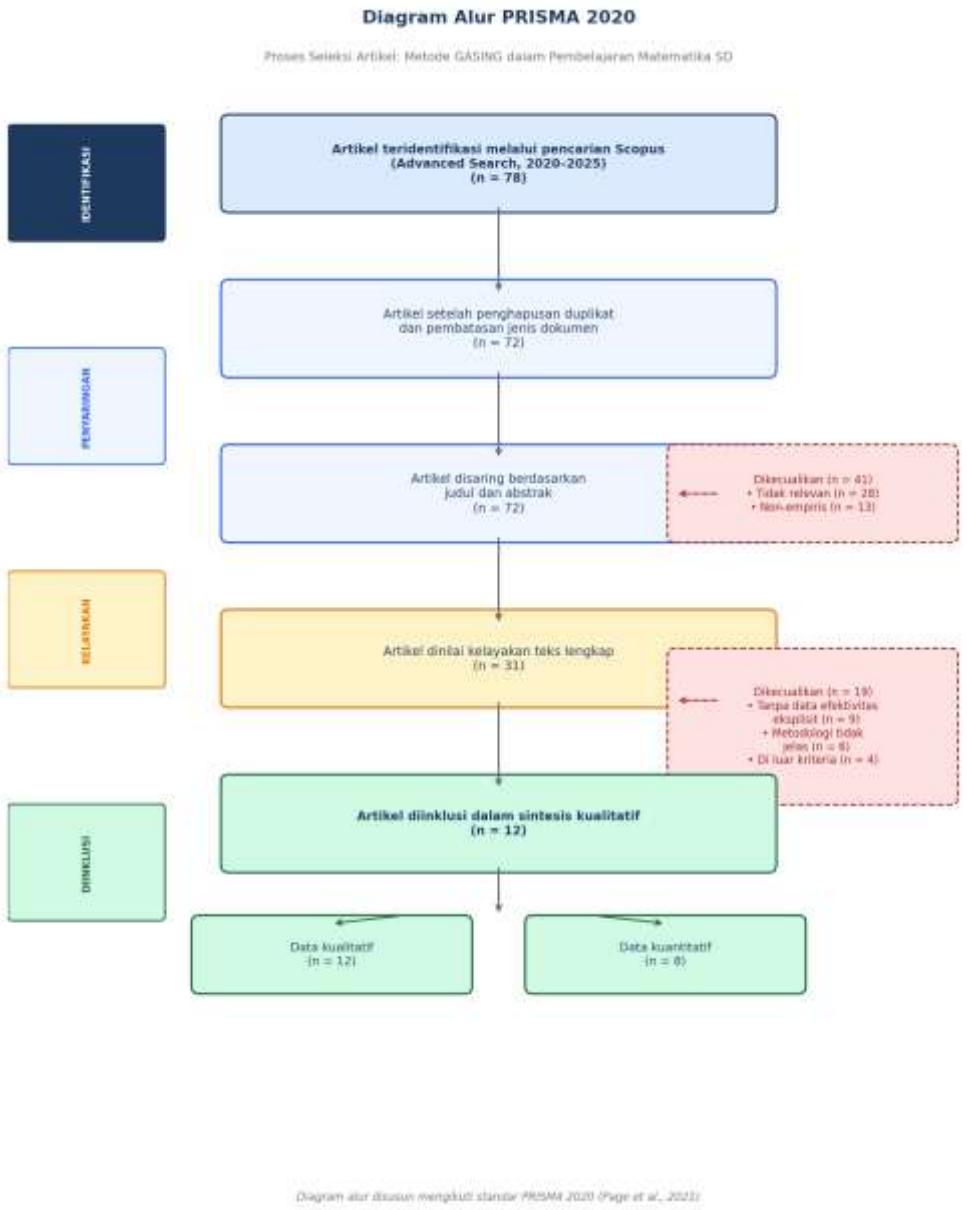


Figure 1. PRISMA 2020 Flowchart: Selection Process Article

Data extraction is performed in a way systematic to every included articles, including : author and year, journal including volume/ number, design research, characteristics samples, variables and instruments measurement, framework theoretical, and findings main. Validity

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extraction maintained through checking cross - *checking* against text complete on every ambiguity found (Wijayanti & Kurniawan, 2022).

Analysis and Synthesis

Data analysis was performed through two approach complementary : (1) analysis thematic inductive For identify patterns and themes cross study, and (2) synthesis narrative in accordance guide Popay et al. (2006) which includes four elements : development theory, synthesis beginning, exploration connection within and between studies, as well as evaluation strength evidence. In the study quantitative which has sufficient data, meta- aggregation is performed limited use statistics descriptive comparative (Rachmadtullah et al., 2023). Assessment quality methodological done use *Mixed Methods Appraisal Tool* (MMAT).

RESULT AND DISCUSSION

Characteristics and Trends Research (RQ1)

Selection process resulting in 12 included articles in synthesis. Table 2 summarizes characteristics general studies The temporal distribution shows acceleration consistent publications : 2020 (n=1), 2021 (n=1), 2022 (n=2), 2023 (n=2), 2024 (n=1), and 2025 (n=5). The peak in 2025 indicates growth interest rapid research to GASING method in five years lastly, possibly triggered by the Independent Learning policy and strengthening of the Assessment program Minimum Competency (AKM) (Alhashem et al., 2022).

In a way geographic, all 12 studies originate from Indonesia, which reflects that GASING method until moment This Still is phenomenon localized research. In terms of level education, the majority focus on school base (n=9), with three studies covers teacher education or higher level wide. From the side methodology, approach quantitative quasi-experimental dominates (n=7), followed by qualitative descriptive (n=3), and method mixed (n=2). Of the 12 articles (Institute, 2020), 10 were article journal and 2 in the form of proceedings conference.

Table 2. Characteristics Included Articles in Synthesis

No	Author (Year)	Journal (Vol.)	Design	Sample	Main Variables	Framework Theory
1	Safitri, Iriawan,	Palapa, 13(2), 238–	Pre-experiment	Elementary School	Understanding procedure	Constructivism

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	& Mufliva (2025)	248	al (one-group pre-post)	Students Phase B	multiplication	
2	Gultom, Panjaitan, & Tambunan (2025)	Studies Horizon, 5(2)	Quasi-experimental	Student second grade elementary school	Learning outcomes mathematics	No explicit
3	Langi & Kondolayuk (2025)	Qalamuna, 17(2)	Analysis conceptual	Theoretical	Construction number round	APOS Theory
4	Jediut, Madu, Ndiung, & Tilan (2025)	J. Mat. Education, 9(1)	Qualitative descriptive	Manggarai Elementary School Teacher	Teacher perception	No explicit
5	Rusali & Todingbua (2025)	J. Mat. & Ed., 4(1)	Quasi-experimental	Teachers in Nabire	Competence pedagogical	Development professional
6	Parwati & Suarjana (2024)	J. of Elementary Science, 8(2)	Method mixture	Elementary school students	Literacy numeracy & metacognition	Ethnomathematics & GASING
7	Hartono & Setiawan (2023)	J. Elementary Education, 11(2)	Quasi-experimental	Third grade elementary school students	Learning outcomes operation count	Constructivism

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8	Susanti & Wahyuni (2023)	Proceedings of SNPMAT 2023	Qualitative	Elementary school teacher	Perception implementation	No explicit
9	Nugroho & Rahmawati (2022)	J. Research of Mat. Education, 9(1)	Quasi-experimental	Fourth grade elementary school students	Understanding conceptual fractions	Constructivism
10	Wijayanti & Kurniawan (2022)	J. Innovation Education, 6(3)	Method mixture	Elementary school teachers & students	Motivation & results Study	No explicit
11	Pramono & Fitria (2021)	ICMSE 2021 Proceedings	Descriptive	Elementary school students	Skills counting	No explicit
12	Hidayat & Marlina (2020)	J. Mat. Education, 14(2)	Quasi-experimental	Fifth grade elementary school students	Learning outcomes number	Constructivism

Operationalization and Measurement Effectiveness (RQ2)

Review of 12 included articles reveal variation significant in method The effectiveness of GASING is operationalized and measured. Based on analysis thematic, three dimensions main effectiveness succeed identified.

First, the dimensions cognitive-procedural, which is quantified through improvement score results Study or understanding procedural use pre-test and post-test instruments. Seven study (58%) placed dimensions This as indicator main. Safitri et al. (Hidayah & Dwiyani, 2024) noted improvement meaningful in a way statistics (Wilcoxon test, $p<0.05$) on understanding procedural

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multiplication student Phase B, while Gultom et al. (2025) documented significant difference in average pre-test to post-test scores in students second grade elementary school (Damopolii et al., 2024).

Second, the dimensions literacy numeracy and metacognitive, which uses indicator more comprehensive from just score test. Parwati and Suarjana (2024) used instrument literacy numeracy AKM based combined with questionnaire metacognition. This multidimensional approach in harmony with direction policy national which places literacy numeracy as fundamental competencies in Independent Learning framework (A. A. Gultom & Usman, 2024).

Third, dimension teacher competence and quality implementation, which measures effectiveness from perspective teacher. Jediut et al. (2025) use questionnaire teacher perception with five- point Likert scale, resulting in findings perception that is general positive to relevance and convenience implementation of GASING. Rusali and Todingbua (Novriani & Yuanita, 2017) used n competency pre-test and post-test design For measure impact training structured to ability arithmetic teacher pedagogical base in Nabire. Diversity dimensions measurement This confirm that the effectiveness of GASING is multidimensional construct that is not can reduced to one indicator single (Diah & Siregar, 2023).

Analysis Langi and Kondolayuk's (2025) conceptual model offers different perspectives with use APOS theory for map construct cognitive that occurs during the GASING learning process. Approach This beyond measuring output and examining the underlying mental processes understanding, so that give contribution unique in explain *Why* GASING method works in a way effective from corner view psychology cognitive (Alabdulaziz, 2022).

Factor Contextual Influence Effectiveness (RQ3)

From the analysis comparative cross study, identified four category factor contextually which is consistent influence variation effectiveness implementation GASING method (Nguyen et al., 2024):

(1) Teacher Readiness and Competence. Rusali and Todingbua (2025) proved that that training structured in GASING method significant increase competence teacher's pedagogical skills, which in turn impact positive on quality implementation in class. Study This use design quasi-experimental with group of teachers who participated training versus group control, produce difference meaningful post-test competencies in a way statistics. Perception positive attitude of teachers towards GASING method documented by Jediut

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et al.(Ireniza & Sari, 2023) added proof that teacher *buy* - in and acceptance is prerequisite success implementation.

(2) **Integration Approach Contextual and Cross- Disciplinary.** Findings Parwati and Suarjana (2024) showed that GASING synergy with learning based ethnomathematics and digital e-evaluation systems produce improvement literacy more numeracy comprehensive compared to implementation of GASING independent. Contextualization material in culture local (in studies this, Balinese context) no only increase relevance content, but also strengthens involvement cognitive and affective student.

(3) **Characteristics Students and Abilities Beginning.** Cross-sectional study studies show that students at the level class low (I–III SD) tends to respond more positive to GASING method, possibility Because stages concrete method This optimally aligned with stage operational concrete development Piaget's cognitive development in the range age said. Heterogeneity ability beginning students also appear repeatedly as a moderator who influences magnitude effect interventions ; studies with low KAM group generally shows more gain big when GASING method is applied in a way consistent.

(4) **Support Institutional and Availability Source Power.** A number of studies in a way explicit and implicit mention that success GASING implementation is also influenced by support structural from head school, sufficiency allocation time training, and availability tool supporting props stage concrete learning. Studies conducted in schools with support strong managerial report level fidelity more implementation high and, consequently, the effects more interventions big.

Framework Theoretical and Design Methodology (RQ4)

Analysis framework theoretical basis used in 12 studies reveal domination constructivism cognitive (n=7) as runway implicit and explicit. APOS theory (Devi, 2024) is used in a way explicit by one studies only (Surya, 2013) , while approach literacy and metacognition applied by one studies others (Parwati & Suarjana, 2024). Interestingly, four studies No in a way explicit mention framework theoretical, a lack methodological limitations ability reader For evaluate coherence between runway theory and design selected research.

From the side design methodological, dominance quasi-experimental (n=7) reflects trend researchers For measure effectiveness through comparison pre-test and post-test scores. Although approach This give proof more causality strong compared to studies descriptive, majority studies use sample from One class or One school, which limits generalizability findings.

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No found none of the studies used *randomized controlled trial* (RCT) or design more *matching* strict A gap necessary methodological overcome in future GASING research (N. R. Z. Putri et al., 2023).

Analysis thematic produce three theme dominant that summarizes overall findings : (1) increase achievements cognitive quantitative as effect the most important reported ; (2) strengthening understanding conceptual and competency numeracy as more effects deep and sustainable ; and (3) the role central teacher competence in optimize GASING implementation. Third theme This allows conceptual model development integrated which places the effectiveness of GASING as results interaction dynamic between design instructional, foundation theoretical, and factors conducive contextual (Hijriani & Simarmata, 2023).

DISCUSSION

Findings review This in a way consistent support proposition that the GASING method provides impact positive on achievement Study mathematics student school basic, a strengthening conclusion paradigm constructivism cognitive about meaningfulness experience Study gradual and concrete (Hartono & Setiawan, 2023). Consistency This in line with prediction APOS theory (Dubinsky & McDonald, 2001): when stage action (manipulation concrete) and process stage (internalization) through semi- concrete representation) is facilitated with good, transition to stage objects and schemas (abstractions mathematically) becomes more sturdy. In the Indonesian context where the 2022 PISA scores are still is at 366 points (Rusali et al., 2025) findings This place GASING as alternative down -to-earth and potential pedagogy implemented in a way wide (D. L. Gultom et al., 2025).

Compared to with individual studies, reviews systematic This give mark plus in the form of synthesis comprehensive that goes beyond limit methodology and context single. Review This documenting evolution focus GASING research from just speed counting going to literacy numeracy and competence of a teacher trajectory that reflects maturation field study this. However Thus, dominance design quasi-experimental with sample limited to one class or One school Still is limitations significant for generalization findings (Sofia et al., 2020).

Inconsistency in operationalize effectiveness from single post-test score, N-gain, up to teacher perception makes things difficult comparison quantitative cross study. To front, adoption standard uniform reporting of effect sizes (e.g. d ≥ 0.4 as threshold effectiveness meaningful according to Hattie, 2009) will strengthen base comparative. (Jediut, Madu, Ndiung, Tilan, et al., 2025). Gap critical other is absence longitudinal study : whether measurable improvement on

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post-test persisted in range time a number of month until One year ? Question This urge For answered so that you can evaluate meaningfulness term long investment pedagogical in GASING method (Parwati et al., 2025).

Implications practical that can withdrawn from review This covers three thing. *First,* teachers who implement the GASING method requires training structured and supported sustainable institutions No training very so that fidelity implementation awake (Pratiwi et al., 2021). *Second,* GASING integration with approach contextual local (ethnomathematics, AKM context) has potential optimize its effectiveness in a way significant. *Third,* development curriculum teacher training in GASING is necessary covers No only aspect procedural, but also understanding runway theoretically so that teachers are able do intelligent adaptation to various context class (Mujib et al., 2020). From the perspective policies, findings This support integration GASING method in literacy programs numeracy national (Yandani & Agustika, 2022), in particular in Independent Learning and Assessment framework Minimum Competence (Hayati et al., 2024).

Review This own a number of necessary limitations recognized in a way transparent. First, search exclusively on Scopus can create publication bias with exclude studies quality indexed in Google Scholar, ERIC, or repository Garuda national. Second, restrictions on two language (Indonesian and English) excluded potential studies speaking area (Surya, 2025). Third, some included articles originate from journal with accessibility limited, so that verification independent some data is not can done completely (Andriani et al., 2019). Power main review This lies in the systematic PRISMA 2020 protocol, transparency of the selection process (visualized in Figure 1), and synthesis narrative integrated that connects theory, methodology, and practice in a way cohesive (Schoenfeld, 2019).

CONCLUSION

Review Library Systematic This answer fourth question study in a way comprehensive. First, the trend study GASING method (2020–2025) shows acceleration significant publications especially in 2025 with domination studies at the Indonesian elementary school level using approach quantitative quasi-experimental. Second, the effectiveness operationalized multidimensionally : from improvement achievements cognitive and understanding procedural, up to competence literacy numeracy, metacognition, and quality teacher's pedagogical. This is prove that the effectiveness of GASING is not can reduced to one indicator single. Third, four factor contextual main proven moderate variation effectiveness : teacher readiness and competence, integration approach contextual, characteristics and abilities beginning students, as well as

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support institutional. Fourth, constructivism cognitive and APOS theory dominate framework theoretically, although integration theory - data still Not yet evenly throughout included studies.

Contribution conceptual review This is integrate previous findings fragmented, clarifying variation indicator effectiveness, and offers perspective integrative : effectiveness the GASING method is results interaction dynamic between design structured instructional, foundation coherent theoretical framework, and factors conducive contextual.

Implications for future research agenda includes : (1) study experimental scale more big with more design rigorous (*randomized controlled trial* or at least *matching design*); (2) use instrument numeracy standardized and aligned with PISA/AKM framework ; (3) longitudinal studies for measure retention knowledge ; (4) exploration effectiveness of GASING at junior high/senior high school level ; and (5) expansion of the search base to Google Scholar and ERIC to reduce publication bias. From the perspective of policies, findings This in a way strong support strengthening development programs professional teacher based evidence and integration systematic GASING method in strategy literacy numeracy national, in line with direction Independent Learning policy

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