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Single Subject Research in Mathematics Education: Systematic Literature Review in The Indonesian Context

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ABSTRACT

Several literature reviews related to Single Subject Research (SSR) have been reported, but reports related to systematic literature review on SSR in mathematics learning in Indonesia are still limited. Therefore, this Systematic Literature Review (SLR) study will report the results of SSR reviews in mathematics learning in Indonesia. There are five research questions to be answered regarding trends, designs, subject characteristics, learning materials, and types of intervention and target changes from SSR. Following the PRISMA flow, 561 articles were identified from three databases (Dimensions, ERIC, and SINTA), then through the screening stage, and finally 53 articles were included for review. The results of the review, in the form of data extraction from each article, were mapped and analyzed using quantitative descriptive methods. The results of the study found that (1) the trend of SSR publications has increased significantly, peaking in 2023, despite fluctuations in some years, (2) the ABA reversal is the most dominant SSR design used, (3) the most dominant characteristics of subjects involved in this SSR are sensory disabilities and special-needs schools, (4) the materials most commonly used in SSR are numbers and operations, and (5) interventions in SSR mostly use learning media or technology, and most target changes in specific mathematical skills. These results recommend expanding the application of SSR to various topics and levels with more complex designs and technology-based interventions in real contexts, in order to support inclusive, adaptive, and sustainable mathematics learning.

Keywords: Mathematics Learning, Inclusive Education, Technology-Based Intervention

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INTRODUCTION

Mathematics education plays a fundamental role in shaping students' logical, analytical, and problem-solving skills (Güner & Erbay, 2021; Öz & Işık, 2024). However, in reality, mathematics is often a subject that is difficult for some students to understand (McMurran et al., 2023), especially for those with learning disabilities or special needs (Adigun et al., 2024; Lievore et al., 2025). This condition requires adaptive and intervention-based learning strategies so that every individual has the same opportunity to master mathematical concepts.

From a theoretical perspective, Single Subject Research (SSR) is grounded in behavioral and learning theories that emphasize observable change, functional relations between intervention and

outcome, and the systematic examination of individualized learning trajectories through repeated measurement across baseline and intervention phases (Kazdin, 2019; Kratochwill et al., 2023). Unlike group-based experimental designs, SSR allows researchers to establish causal inferences at the level of the individual learner, making it particularly suitable for educational contexts where learning progress is highly variable and individualized responses to instruction are expected.

In mathematics education, learning development is sensitive to individual differences in prior knowledge, cognitive processing, and instructional responsiveness, especially among students with learning difficulties or special educational needs (Gast et al., 2018; Widodo, Kustantini, et al., 2021). Small changes in conceptual understanding or procedural fluency at the individual level may therefore result in meaningful differences in learning progress over time. Within this context, SSR provides a theoretically coherent and methodologically robust framework for capturing these incremental changes and for examining the functional relationship between specific instructional strategies and students' mathematical performance, such as problem solving, number sense, and conceptual understanding, in both regular and inclusive classroom settings (Gast et al., 2018; Prahmana, 2021).

In the Indonesian context, the implementation of mathematics education faces additional challenges related to inclusive education. Many schools, both special-needs schools and inclusive regular schools, serve students with highly diverse learning characteristics, including sensory disabilities, learning difficulties, and developmental disorders (Rante et al., 2020; Z. P. Sari et al., 2022; Soeharto et al., 2024). These students often experience barriers in accessing abstract mathematical concepts, following classroom instruction, and demonstrating learning progress in conventional group-based teaching settings (Adigun et al., 2024; Lievore et al., 2025). As a result, teachers are required to apply highly adaptive, individualized, and evidence-based instructional strategies to ensure that all students have equal opportunities to learn mathematics meaningfully.

Building on these theoretical and contextual considerations, a research approach that can capture individual learning trajectories and the direct effects of instructional interventions is needed. One relevant methodological approach is SSR (Aldousari, 2024; Kim et al., 2020). SSR is a quantitative experimental method that focuses on measuring changes in the behavior or academic performance of individual learners or small groups through repeated observations across baseline and intervention phases (Aldousari, 2024; Prahmana, 2021; Widodo, Kustantini, et al., 2021). Because it allows researchers and teachers to closely monitor how specific interventions affect individual learners over time, SSR is particularly suitable for inclusive and special education contexts, including mathematics learning in Indonesia.

Several literature reviews related to SSR have been published, but they remain fragmented in terms of scope and analytical focus. Reviews by Healy et al. (2021) and Hustyi et al. (2023) concentrate

on behavioral and developmental interventions for individuals with autism, while Luck et al. (2024), and Maber-Aleksandrowicz et al. (2016) examine SSR mainly in clinical and disability-related contexts. These studies provide important evidence on intervention effectiveness, yet they do not examine how SSR is applied to academic domains such as mathematics, nor do they compare designs, learner characteristics, learning materials, and intervention types within an educational framework. Kratochwill et al. (2023) further contribute by refining methodological standards for single-case designs, but their work does not analyze empirical trends of SSR implementation in subject-specific learning contexts. In the Indonesian setting, Widodo, Kustanti, et al. (2021) reviewed SSR in mathematics learning during the Covid-19 new normal period, but their study was narrative in nature and restricted to a specific temporal context.

Overall, existing studies show that research on SSR in mathematics education—especially in Indonesia—exists in various contexts, designs, and analytical dimensions. This fragmentation makes it difficult to identify dominant patterns, research trends, and under-explored areas using individual or narrative approaches alone. To date, studies that systematically synthesize SSR in Indonesian mathematics education across publication trends, research designs, subject characteristics, learning materials, and intervention targets and outcomes using a PRISMA-based SLR approach are still limited. Therefore, SLR is the most methodologically appropriate, as it enables a transparent, replicable, and comprehensive synthesis of empirical evidence across multiple dimensions, allowing for a structured mapping of trends and gaps that cannot be achieved through narrative reviews or individual empirical studies. Addressing these unanswered questions requires a comprehensive SLR that explicitly examines each of these dimensions.

Therefore, this study was conducted in the form of a systematic literature review with the aim of conducting a systematic review of to systematically examine the implementation of the SSR method in mathematics learning in Indonesia by addressing five research questions (RQs)—RQ1: What are the trends in SSR publications on mathematics learning in Indonesia; RQ2: What is the most dominant SSR design used in mathematics learning in Indonesia; RQ3: What are the most dominant characteristics of SSR subjects in mathematics learning in Indonesia, in terms of educational conditions and levels; RQ4: What are the most dominant mathematics learning materials used in SSR in Indonesia; and RQ5: What are the most dominant interventions and change targets applied to SSR in Indonesia. The findings of this study are expected to not only contribute academically to the development of SSR research in the field of mathematics learning, but also serve as a practical reference for teachers in choosing intervention strategies, as well as provide an empirical basis for policymakers to design more inclusive education policies.

METHOD

This study used a Systematic Literature Review (SLR) with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol. SLR is understood as a method that is carried out systematically to identify, evaluate, and synthesize the results of previous studies in order to obtain a complete understanding of a particular topic (Snyder, 2019). The selection of SLR in this study was based on the need to map the development and implementation of SSR in mathematics learning, because SSR is widely used to assess the effectiveness of learning interventions for students with special needs and in the context of individual learning (Widodo, Kustantini, et al., 2021). Meanwhile, PRISMA was chosen because it provides a clear and transparent flow in the article selection process, from identification to inclusion, so that the review results are accountable (Page et al., 2021). The combination of SLR and PRISMA is expected to provide a strong methodological foundation in obtaining a comprehensive picture of the application of SSR in mathematics education. The PRISMA flow in this study, adapted from Haddaway et al. (2022), can be seen in Figure 1.

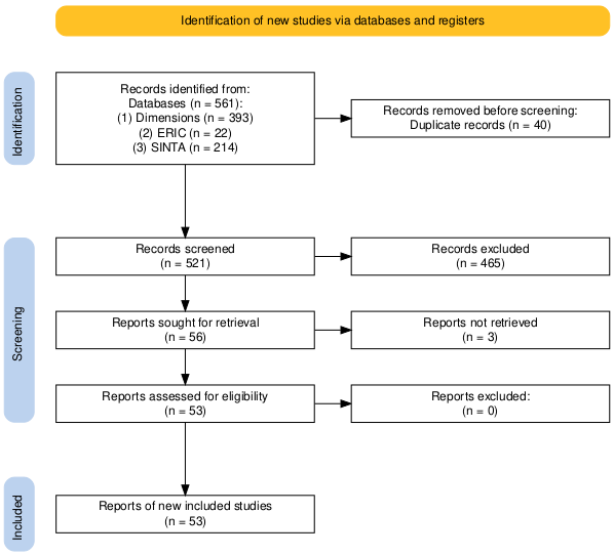

Figure 1. PRISMA Flow

Figure 1 shows the PRISMA flow of this study, which includes the identification, screening, and inclusion stages. The literature search was designed based on the PICOS (Participant, Intervention, Comparison, Output, and Setting) principle (Ishartono et al., 2022), in which different components were operationalized at different stages of the review process.

In the identification stage, the Intervention (I) and Setting (S) components were used to construct the database search in order to achieve high sensitivity and avoid prematurely excluding relevant studies. Specifically, the Intervention terms ("single subject research" OR "single subject design" OR "single case design") were combined with the Setting terms ("mathematics" OR "math" OR "mathematics

learning") using the Boolean operator AND. This Boolean strategy was applied consistently across all databases.

The search was conducted in three databases—Dimensions, ERIC, and SINTA—which were to represent international, education-focused, and national literature sources. The use of multiple databases follows SLR methodological recommendations to increase coverage and reduce publication bias (Ewald et al., 2022; Li et al., 2019). Using this Boolean search strategy for the period 2016–2025, Dimensions yielded 393 records, ERIC contributed 22 peer-reviewed records, while SINTA provided 146 national records. In the total 561 records were retrieved on August 5th, 2025, of which 40 duplicates were removed.

The remaining 521 records were screened based on titles and abstracts. For records in which the use of SSR was not explicit in the title or abstract, the full text was examined to determine whether an SSR design was applied. At this stage, the Participants (P), Intervention (I), Setting (S), and Outcomes (O) criteria were applied to determine eligibility. Articles were excluded if they were non-scientific (58 records), not conducted in the Indonesian context (274 records, Setting), or did not employ SSR in mathematics learning (130 records, Intervention and Setting). This screening ensured that the retained studies matched the scope and objectives of the review (Xiao & Watson, 2019). Subsequently, 56 full-text articles were sought for retrieval. Three articles were excluded at this stage (two inaccessible full texts and one literature review), resulting in 53 studies being assessed for eligibility. No further exclusions were made, in accordance with PRISMA guidelines emphasizing transparency in article selection (Page et al., 2021).

Finally, 53 studies were included for data extraction. Two researchers independently coded each article in terms of publication year, SSR design, participant characteristics (P), learning materials (S), types of intervention (I), and outcome or target changes (O) in order to address the five research questions. Inter-coder reliability (between the two researchers) was tested using Cohen's Kappa, which showed a value of 0.81 (strong agreement) (McHugh, 2012). Coding differences were resolved through discussion until consensus was reached.

The data extracted from the articles, with the help of Google Spreadsheets, was then tabulated and mapped, and further analyzed descriptively and quantitatively. This approach is commonly used in SLR because it allows researchers to organize their findings in a concise, transparent, and easily interpretable manner (Xiao & Watson, 2019). Findings related to RQ were then presented in a concise narrative form to provide a clear and systematic overview.

RESULTS & DISCUSSION

In this SLR, 53 articles related to SSR in mathematics learning in Indonesia that were included in the PRISMA flow in Figure 1 were analyzed to answer the five RQs. The findings and explanations of each RQ will be discussed in the following subsections.

Result

Trends in SSR Publications on Mathematics Learning in Indonesia (RQ1)

The trend in the number of publications from 2016 to 2025 is presented to show that interest in SLR publications related to mathematics education in Indonesia has changed over time. The distribution of the number of publications is shown in Figure 2.

The results of the analysis in Figure 2 show that SSR publications in mathematics education in Indonesia in the period 2016–2025 have increased significantly, despite fluctuations in some years. Since 2016, when no publications were found, the trend began to emerge in 2017 and continued to increase, peaking in 2023 with 14 articles and declining in the last two years.

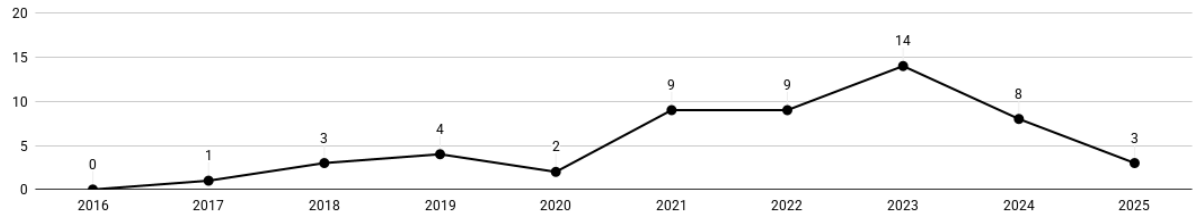

Figure 2. Distribution of The Number of SSR Publications

Figure 2 also indicates that researchers' interest in SSR in mathematics learning in Indonesia has grown, especially after 2020. This increase can be attributed to awareness of the importance of the SSR method in evaluating the effectiveness of learning interventions in depth on individuals or small groups (Gast et al., 2018; Kazdin, 2019).

SSR Design in Mathematics Learning in Indonesia (RQ2)

In general, SSR designs are divided into two types: reversal designs and multiple baseline designs (Gast et al., 2018; Prahmana, 2021; Widodo, Kustantini, et al., 2021). Furthermore, the reversal design consists of the AB, ABA, ABAB, BAB, ABCB, and Another types (Prahmana, 2021; Widodo, Kustantini, et al., 2021). Meanwhile, multiple baseline designs include multiple baselines across behaviors, multiple baselines across behavior subjects, and multiple baselines across settings or conditions (Prahmana, 2021; Widodo, Kustantini, et al., 2021). The distribution of the number of articles for each type of SSR design is detailed in Figure 1.

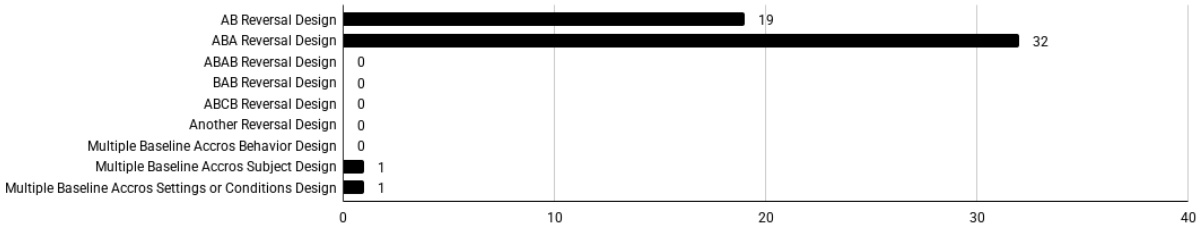

Figure 1. Distribution of The Number of Articles for Each Type of SSR Design

From Figure 1, the ABA reversal design as the most dominant design (32 articles) appearing in articles at the inclusion stage indicates that this design is most frequently used. The ABA reversal design is an SSR design consisting of three phases—first, the baseline phase (A1); second, the intervention phase (B); and third, the phase where the intervention is withdrawn and returned to the original condition or baseline (A2) (Prahmana, 2021; Widodo, Kustantini, et al., 2021). This design is interesting because it emphasizes the importance of observation in phase A2 to convince researchers that the effects observed in the target change are truly caused by the intervention provided, not by other factors (Widodo, Kustantini, et al., 2021). The ABA design provides stronger evidence of behavioral or academic performance changes than the AB design due to the return phase to the initial condition (A2), which functions as an internal control. This makes it an attractive option for teacher-researchers and school practitioners who need practical yet reliable evidence.

The ABA design was used by A. G. Putri and Leonard (2025) to improve the multiplication skills of students with dyscalculia using the Garismatika method. In the same year, an article by Basudewa and Suparmi (2025) also used this design to introduce geometric shapes to deaf students with intellectual disabilities, and there are many other articles discussing the use of this ABA reversal design in mathematics learning (Irfan et al., 2023; Nahwah et al., 2017; Rustami & Taufan, 2022).

The next dominant reversal design sequence in Figure 1 is type AB, with 19 articles. AB design is defined as the most basic design in SSR (Prahmana, 2021). It is referred to as a basic design because it consists of only two main phases of SSR, starting with the baseline phase (A) followed by the intervention phase (B) (Widodo, Kustantini, et al., 2021). This design can be said to be simpler when compared to the ABA reversal design, which consists of three phases. The AB design is widely used in studies with time constraints and tight schedules. This reflects that the choice of research design is often determined by the practical context in the field, such as the short duration of the intervention, curriculum load, or time flexibility in school facilities. Although the AB design has lower internal validity than ABA, its use remains relevant because it provides an initial picture of the effectiveness of a learning strategy.

For example, an article by Malasari and Widodo (2025) used AB design to improve algebraic thinking in introverted students through peer tutoring with Gusjigang wisdom, and there are many others (Ariyani & Maharani, 2023; Arvianto & Ginting, 2021; Giyanti & Oktaviyanthi, 2024). These results

indicate that the ABA and AB reversal designs are still the dominant choices in SSR research on mathematics learning in Indonesia, in line with previous studies showing that both designs are relatively simple but effective in detecting changes in behavior or learning skills in single subjects (Gast et al., 2018).

In addition to the two types of reversal designs described above, there are also articles that use multiple baseline designs, although in very small numbers. Multiple baseline designs involve repeated measurements in each baseline phase and intervention phase simultaneously (Prahmana, 2021). In the article by Nashiruddin et al. (2022), a multiple baseline across subject design was used, involving three visually impaired students to test the effectiveness of developing a learning medium called Barusida to improve conceptual understanding. This research design focuses on measurements from several subjects for the same intervention (Prahmana, 2021).

Another multiple baseline article by Hafidah and Rukli (2022) used an across settings or conditions design to train slow learners in learning repeated addition using the realistic mathematics education (RME) approach with two condition designs, namely at home and at school. According to Prahmana (2021), this research design focuses on measurements from different settings or conditions.

In addition to the four types of designs described above, according to Gast et al. (2018), Prahmana (2021), and Widodo, Kustantini, et al. (2021), there are other types of reversal designs—ABAB, BAB, ABCB, and another—as well as multiple baseline designs—across behavior (see Figure 1), but no articles from studies using them have been found.

Characteristics of Subjects Involved in Mathematics Learning SSR in Indonesia, Reviewed from the Perspective of Their Conditions and Educational Levels (RQ3)

In this SLR, the characteristics of subjects in SSR mathematics learning in Indonesia are reviewed from two perspectives—the conditions of the subjects and their educational levels. These two reviews are usually used to determine the need for intervention and appropriate pedagogical approaches at each stage of learning development.

From the review results, seven subject conditions of SSR were found—sensory disability, learning difficulties, intellectual disability, psychological & personality conditions, developmental disorders & neurodiversity, general condition, and multiple disability. The detailed distribution of the number of articles for each subject condition of SSR can be seen in Figure 2.

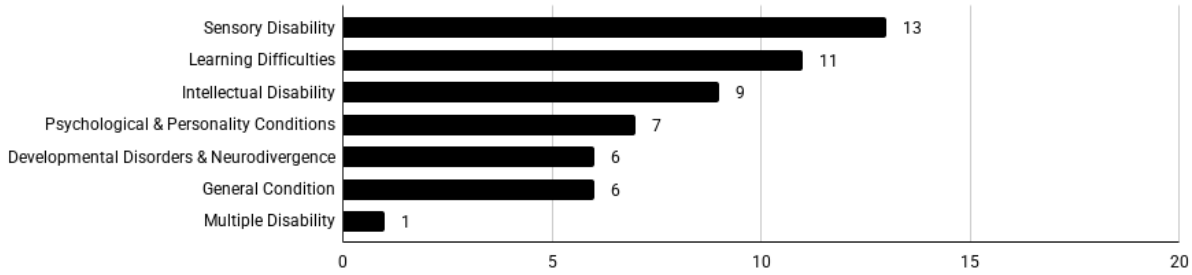

Figure 2. Distribution of The Number of Articles for Each Subject Condition of SSR

Based on Figure 2, sensory disability is the most dominant condition among SSR subjects, with 13 articles. Sensory disability is defined as a physical limitation that affects vision, speech, hearing, or language (Brown et al., 2020; Heideveld-Gerritsen et al., 2021). In the articles by Husniyyah et al. (2021), Nahwah et al. (2017), and Sasmita & Harjono (2021), SSR was conducted with subjects with sensory disabilities, specifically visual impairments. In addition, SSR articles were also found with subjects experiencing hearing impairment (Ediyanto et al., 2023; Tasliah et al., 2019). The dominance of sensory disabilities indicates that SSR is widely used to overcome barriers to accessing visual or auditory mathematical information, thus requiring intensive individual monitoring.

The next dominant condition in SSR subjects was learning difficulties (see Figure 2) with 11 articles. Learning difficulties are defined as a condition in which an individual's actual performance is below the expected performance in academic endeavors due to difficulties related to basic psychological processing functions, such as difficulties in arithmetic, writing, reading, and self-expression (Al-Qadri et al., 2021). A total of three articles explicitly mentions the condition of SSR subjects with learning difficulties (Ananda & Damri, 2021; Ariyani & Maharani, 2023; Utami & Kasiyati, 2020).

In addition to being explicitly stated, learning difficulties are also implied, one example being the term slow learner. A total of 8 articles mentioned that they involved subjects with slow learner conditions in their research, including studies conducted by Manikmaya and Prahmana (2021), Majid et al. (2021), and Zulfa and Andriyani (2023). These slow learner students have characteristics such as often being immature in interacting with others, performing poorly in school, and not easily mastering academic skills (Wardani & Prahmana, 2021). Subjects with learning difficulties generally face challenges in numeracy and information processing skills, making SSR the right choice because it allows for gradual intervention and more detailed progress tracking.

In addition to the two conditions described above, there are five other SSR subject conditions. The condition of intellectual disability (Wissink et al., 2015) with 9 articles covers mental retardation (Rustami & Taufan, 2022), intellectual disability (Hastuti et al., 2023), and mental retardation (Salsabila & Permatasari, 2024). The psychological & personality condition (Lewis, 2015; Otero-González et al., 2024) with 7 articles covers introvert type (Malasari & Widodo, 2025), extrovert (Widodo et al., 2022), phlegmatic (Widodo et al., 2022), field dependent (Arvianto & Ginting, 2021), and anxiety disorders

(Safitri et al., 2023). Next, there were 6 articles each on developmental disorders & neurodivergence (Ogden et al., 2016; Scheinost et al., 2023) —ADHD (Huda & Agustyaningrum, 2019), cerebral palsy (Sutisna & Rahmawati, 2018), dyslexia (Ismail et al., 2023), dyscalculia (Widodo, Prihatiningsih, et al., 2021) and general conditions. Finally, there was 1 article on multiple disabilities (Çay & Bozak, 2025) that specifically covered intellectual and sensory disabilities (Basudewa & Suparmi, 2025).

Meanwhile, the review found six levels of education for SSR subjects in mathematics learning in Indonesia—special-needs schools, early childhood/kindergarten, elementary schools, junior high schools, senior high schools, and higher education. The detailed distribution of the number of articles from each level of education for SSR subjects can be seen in Figure 3.

Figure 3. Distribution of The Number of Articles for Each Educational Level of SSR

Based on Figure 3, special-needs schools are the most dominant level of education for SSR subjects in mathematics learning in Indonesia, with 17 articles. One reason for this dominance is that most SSR subjects have disabilities—sensory, intellectual, or multiple (see Figure 3)—and therefore need to attend special needs schools. Special needs schools are schools specifically for students with disabilities or learning difficulties (Horridge, 2019). A total of 3 articles (Hadi et al., 2022; Husniyyah et al., 2021; Nahwah et al., 2017) reported conducting research in type A special-needs schools that focus on students with visual disabilities. Furthermore, 7 articles each reported conducting research on type B special needs schools—hearing disabilities and type C—intellectual or mental disabilities. Articles by Fatillah and Irdamurni (2023), Kobiliah et al. (2024), and Wati et al. (2024) are examples of research conducted at type B special needs schools. Furthermore, articles by Huda and Agustyaningrum (2019), Sari and Damri (2023), and Widodo, Prihatiningsih, et al. (2021) are examples of research conducted in type C special-needs schools. Meanwhile, other types of special-needs schools—D (physical disabilities), E (emotional disabilities), and G (multiple disabilities)—have not been found so far.

This dominance shows that SSR is still closely associated with the individualized instruction approach commonly used in special education. The use of SSR among students with special needs is in line with international practices, as the SSR design allows researchers and teachers to monitor individual responses in more detail, especially in learning contexts that require intensive adjustments.

Not much different from special schools, the next dominant level of education is junior high school with 16 articles (see Figure 3). For example, an article by Arvianto and Ginting (2021) conducted SSR on subjects in junior high school using problem posing learning to improve creative thinking skills. There are also other articles that conducted SSR on subjects in junior high school to improve critical thinking skills (Sulistyowati et al., 2022; Yanti et al., 2018), mathematical reasoning skills (Irfan et al., 2023; Widodo et al., 2020), and many others (Fitriyah et al., 2023; Nashiruddin et al., 2022; Widodo et al., 2022).

This reflects the tendency of researchers to apply SSR to age groups that are still in the basic developmental stage, where numeracy skills and early arithmetic abilities are the main focus of learning. In addition, students in the elementary school age range often exhibit considerable variation in individual abilities, requiring a more personalized and structured learning approach—characteristics that are consistent with the objectives of using SSR.

In addition to the two levels of education from the SSR subject that have been described, there are four others. The elementary school level with 12 articles (Utami & Kasiyati, 2020), the higher education level with 4 articles (Sholahudin & Oktaviyanthi, 2023), early childhood/kindergarten level with 3 articles (Basudewa & Suparmi, 2025), and finally the senior high school level with 1 article (Zulfa & Andriyani, 2023).

Mathematics Learning Materials Used in SSR in Indonesia (RQ4)

Six groups of mathematics learning materials used in SSR in Indonesia were found from the review results—numbers & operations, algebra, geometry & measurements, statistics & data, calculus/analysis, and integrated/general topics. The detailed distribution of the number of articles from each category of mathematics learning materials in SSR in Indonesia can be seen in Figure 4.

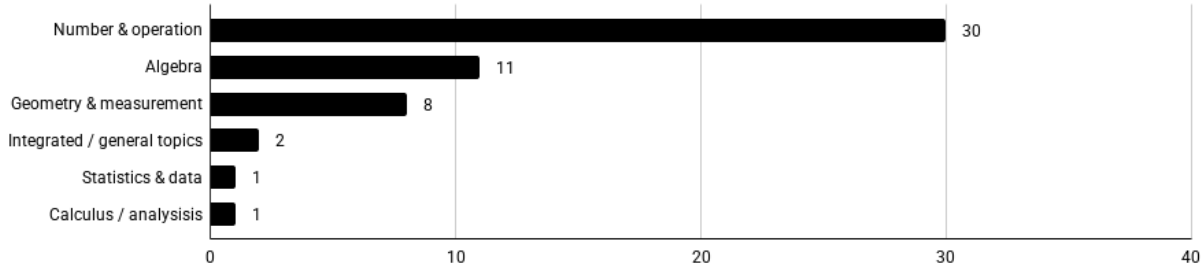

Figure 4. Distribution of The Number of Articles for Each Mathematics Learning Materials Used of SSR

From Figure 4, numbers and operations are the most widely used mathematics learning material in SSR in Indonesia, with 30 articles. Number and operation is one of the first five standards in the mathematics content objectives taught at all levels of education (National Council of Teachers of Mathematics (NCTM), 2019). In mathematics, number and operation are closely related. Operations in mathematics are defined as cognitive actions performed to calculate the relationship between numbers

(Istomina & Arsalidou, 2024). Several learning materials in the number & operation group are used in this SSR. For example, fraction materials and their operations are used in SSR for students with visual impairments (Nahwah et al., 2017), deaf-mute students (Jannah & Prahmana, 2019), and students with learning difficulties (Majid et al., 2021). Other articles also mention that arithmetic operations such as addition, subtraction, multiplication, and division are used in SSR with various subject characteristics (Kobiliah et al., 2024; Rusyani et al., 2021; Sasmita & Harjono, 2021). Finally, the ability to determine place value (Ananda & Damri, 2021; Utami & Kasiyati, 2020) and number/digit recognition (Istiqomah et al., 2022; Rustami & Taufan, 2022) are also learning materials that are often used in SSR in the number & operation category.

The dominance of this material reflects that SSR is widely used to address learning difficulties in fundamental mathematical skills, which are prerequisites for mastering advanced concepts. The dominance of the focus on numbers and operations is also in line with the characteristics of the majority of research subjects who come from elementary school levels and groups of students with special needs who require intensive and structured instructional intervention.

The next most frequently used mathematics learning material in this SSR is algebra, with 11 articles. Algebra is also included in one of the first five standards in the mathematics content objectives taught at all levels of education, in addition to number and operations—which has been described previously—geometry, measurement, and data analysis and probability (National Council of Teachers of Mathematics (NCTM), 2019). Several learning materials in the algebra group are also used in this SSR. For example, algebraic operations are used in SSR for students with introverted (Widodo et al., 2020) and extroverted (Widodo et al., 2022) psychological and personality conditions. In addition, materials on equivalent and inverse values (Ariyani & Maharani, 2023; Manikmaya & Prahmana, 2021; Wardani & Prahmana, 2021) and two-variable linear equation systems (Sulistyowati et al., 2022; Ulfah & Prahmana, 2018) are also learning materials in this algebra category.

In addition to these two groups of mathematics teaching materials, there are four others. The geometry & measurements group has 8 articles (Sutisna & Rahmawati, 2018; Yanti et al., 2018), the integrated/general topic category has 2 articles (Fitriyah et al., 2023; Safitri et al., 2023), while there is one article each in the statistics & data category (Arvianto & Ginting, 2021) and calculus/analysis category (Tonra et al., 2024).

Interventions and Change Targets in SSR in Mathematics Learning in Indonesia (RQ5)

In addition to the four RQs discussed above, it is also important to map interventions and targets for change in mathematics learning SSR in Indonesia. The two are closely related.

From the review results, five types of interventions were found to be used in SSR—learning media or technology, teaching strategies, problem-/project-based approach, multiple intervention, and

behavioral intervention/classroom management. The detailed distribution of the number of articles from each intervention category in mathematics learning SSR in Indonesia can be seen in Figure 5.

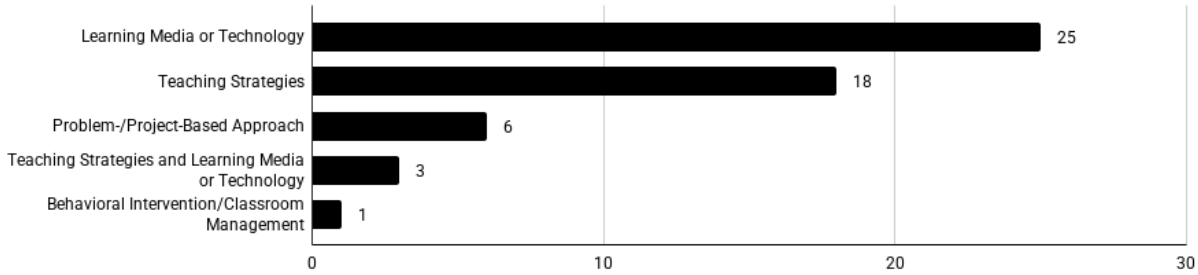

Figure 5. Distribution of The Number of Articles for Each Interventions of SSR

As can be seen in Figure 5, learning media or technology is the most dominant type of intervention used in SSR, with 25 articles. The learning media used in SSR in Indonesia are still concrete and manipulative, such as abacus (A. I. Sari & Damri, 2023), ice cream sticks (Ediyanto et al., 2023; Rahayu et al., 2024), and fraction blocks (Nahwah et al., 2017). This shows a strong orientation towards a kinesthetic and concrete approach in mathematics learning, especially for students with special needs or learning difficulties. However, technology-based media such as interactive videos (Widodo, Prihatiningsih, et al., 2021) and games (Wardany & Ulfa, 2022) are beginning to emerge, signaling a shift towards more adaptive digital learning. These findings indicate an initial trend toward the use of technology as part of SSR interventions, especially for groups that require multisensory support.

Teaching strategies were the next dominant type of intervention used in this SSR, with 18 articles. Examples include contextual and realistic approaches—CTL (Manikmaya & Prahmana, 2021; Salsabila & Permatasari, 2024) and RME/IRME (Adjie et al., 2021; Ariyani & Maharani, 2023; Wardani & Prahmana, 2021). In addition, multi-sensory and kinesthetic methods such as VAKT (Sutisna & Rahmawati, 2018) and Jarimatika (Sasmita & Harjono, 2021; Tasliah et al., 2019) are also frequently used, especially for students with learning disabilities and special needs, as they can improve focus and conceptual understanding through direct experience.

In addition to the two types of interventions described above, there are three others. Interventions with a problem-/project-based approach (Arvianto & Ginting, 2021; Widodo et al., 2020; Yanti et al., 2018) with 6 articles. The multiple intervention type, or a combination of learning media or technology with teaching strategies, with 3 articles (Jannah & Prahmana, 2019; Majid et al., 2021; Rusyani et al., 2021). Finally, there is 1 article on behavioral intervention/classroom management (Huda & Agustyaningrum, 2019).

Meanwhile, the review found seven types of change targets in mathematics learning SSR in Indonesia—spesific mathematical skills, symbolic ability and basic conceptual understanding, mathematics learning outcomes, spesific cognitive abilities, emotional or psychological aspects, learning behaviors (motivation, attention & memory), dan mathematics learning outcomes and basic conceptual

understanding. The detailed distribution of the number of articles from each category of change targets in mathematics learning SSR in Indonesia can be seen in Figure 6.

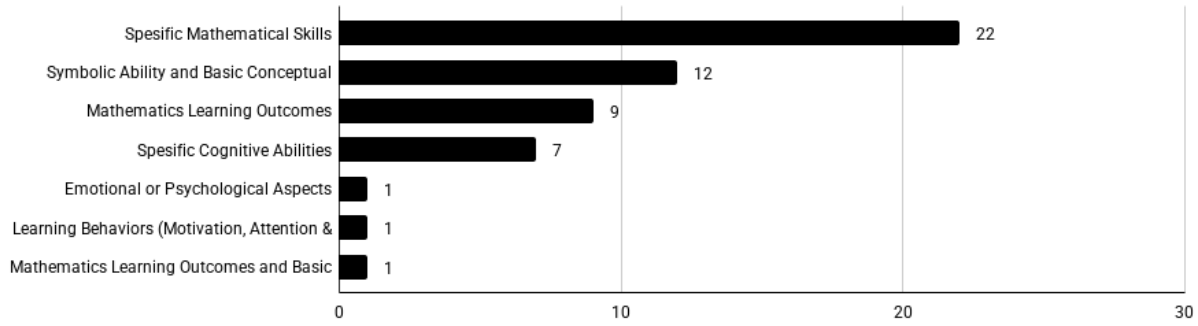

Figure 6. Distribution of The Number of Articles for Each Change Targets of SSR

As can be seen in Figure 6, specific mathematical skills are the most dominant type of change target in this SSR with 22 articles. One of the specific mathematical skills that is the target of change is general calculation skills, as in the research by Ediyanto et al. (2023) and Rahayu et al. (2024), who conducted SSR using ice cream sticks. A similar target was also found in the research by Huda & Astyaningrum (2019), who conducted SSR with a sensory integration approach. In addition, several SSR studies targeted changes in specific mathematical abilities, including addition skills (Kobiliah et al., 2024; N. A. Putri & Marlina, 2024), multiplication skills (Sasmita & Harjono, 2021; Tasliah et al., 2019), and basic arithmetic operations (Rusyani et al., 2021).

Symbolic ability and basic conceptual understanding are the next most dominant types of change targets in this SSR, with a total of 12 articles. This type of target focuses on developing basic skills in recognizing mathematical symbols, as in the study by Wati et al. (2024), who conducted SSR using symbol boards on subjects with hearing impairments. In addition, SSR is also used for number recognition (Ismail et al., 2023; Istiqomah et al., 2022) and number concepts (Ananda & Damri, 2021; Widodo, Prihatiningsih, et al., 2021)**.**

In addition to the two types of change targets that have been described, there are three others. The types of change targets are mathematics learning outcomes (A. I. Sari & Damri, 2023; Wardany & Ulfa, 2022) and learning achievement (Widodo et al., 2022), with a total of 9 articles. Next, specific cognitive abilities (Widodo et al., 2020; Yanti et al., 2018) with a total of 7 articles. Finally, there was one article each on the types of change targets of emotional or psychological aspects (Safitri et al., 2023), learning behaviors (motivation, attention & memory) (Salma & Prasetyawati, 2023), and mathematics learning outcomes and basic conceptual understanding (Jannah & Prahmana, 2019). This indicates that SSR in the Indonesian context is still more focused on measuring observable and quantitative learning outcomes rather than more complex cognitive or affective developments.

Discussion

From the five RQs, five important findings were obtained. The first finding (from RQ1) is that the trend of SSR publications increased, peaking in 2023, despite fluctuations and a decline in the last two years. This finding highlights the importance of maintaining the sustainability of SSR research. This finding highlights the importance of maintaining the sustainability of SSR research by ensuring that methodological rigor and research continuity are preserved despite contextual and institutional fluctuations that may influence annual publication output. Future researchers are advised to explore new topics, broaden the subject and material contexts, and strengthen collaboration to ensure that publication trends remain consistent and have a broader impact.

The second finding (from RQ2) is that the most dominant SSR design used is the ABA reversal type, followed by the AB reversal type. Therefore, this finding can provide an overview for future researchers by identifying a clear methodological gap where SSR rigor can be strengthened through more systematic use of multiple baseline designs without disregarding practical constraints. Meanwhile, multiple baseline designs are still rarely used. This finding indicates that more complex designs such as the multiple baseline type, despite having advantages in increasing internal validity, are less frequently used (Kazdin, 2019). Therefore, this finding can provide an overview for future researchers that there are opportunities to use more complex designs such as multiple baselines in conducting SSR. Meanwhile, practitioners can use the ABA and AB SSR designs that are commonly used in providing interventions in single-subject-based learning.

The third finding (from RQ3) is that the most dominant characteristic of the subjects involved in this SSR is sensory disability. This dominance can be explained by the relatively clear behavioral and academic indicators associated with sensory disabilities, which align well with the observational and individualized nature of SSR. On the other hand, the focus on groups with multiple disabilities, such as intellectual and sensory disabilities simultaneously, is still very rarely involved as research objects, with only one article (see Figure 2). This shortcoming opens up great opportunities for further exploration by researchers regarding the effectiveness of the SSR approach designed for the complex needs and combination of student conditions, especially multiple disabilities.

In addition, RQ3 also found that the most dominant characteristics of subjects involved in this SSR were at the special-needs school level. This pattern reflects the strong association between SSR and individualized instructional practices that are traditionally emphasized in special education contexts. Conversely, the limitations of research at the senior high school and higher education levels are strategic gaps that need to be explored further (see Figure 3), especially given the low participation of students with disabilities on higher education. Therefore, the findings of this SLR should be interpreted primarily within the context of special and inclusive education, rather than generalized to all mathematics learning settings.

The fourth finding (from RQ4) is that the most dominant learning material used in SSR is numbers and operations. The emphasis of most researchers on this material is understandable because these skills form the foundation for higher-level mathematical understanding and are crucial for students with learning difficulties or special needs. In addition, foundational skills are more easily operationalized and measured within single-subject designs, making them more frequently selected as SSR targets. On the other hand, the low number of other materials used, such as algebra, geometry and measurement, statistics, and calculus (see Figure 4), indicates a significant research gap. Future research can expand the implementation of SSR to explore interventions in more complex areas of mathematics such as problem solving, reasoning, or data literacy, which are increasingly important, especially in subjects that are still underutilized.

The fifth finding (from RQ5) shows that media-based or learning technology-based interventions are most predominantly used in mathematics learning SSR in Indonesia (see Figure 5). This dominance reflects the suitability of concrete, manipulative, and digital media for individualized instruction, which aligns closely with the core principles of SSR. This dominance indicates that researchers focus more on innovations in tools and instructional methods than on behavioral interventions or problem/project-based approaches. However, problem/project-based and multi-intervention approaches are still rarely applied, even though both have great potential in developing higher-order thinking skills and the contextual application of mathematical concepts. Therefore, further research is recommended to explore more complex and contextual interventions, including the integration of digital media with project-based or problem-based learning approaches. Meanwhile, for education practitioners, these findings can serve as a basis for optimizing the use of adaptive learning media and interactive technology, tailored to the individual needs of students in the context of inclusive learning.

In addition, RQ5 also found that the focus of change targets in SSR in mathematics learning in Indonesia is still predominantly on Specific Mathematical Skills, while affective aspects, learning behavior, and higher-order thinking skills are still very limited (see Figure 6). This pattern suggests that SSR has primarily been used to examine observable and short-term cognitive outcomes that are easier to document at the individual level. This indicates that the interventions carried out tend to be oriented towards improving basic cognitive abilities and academic learning outcomes. Therefore, further research is recommended to expand the target of change towards the development of higher-order thinking skills as well as affective and behavioral aspects, so that SSR interventions are more comprehensive and reflect the needs of holistic mathematics learning.

Taken together, these findings indicate that the contribution of this study lies not merely in mapping research topics, but in providing an empirical and methodological synthesis of how SSR has

been implemented in mathematics education in Indonesia. By identifying dominant design choices, subject characteristics, instructional focuses, and outcome targets, this review offers a structured basis for strengthening SSR methodological rigor and expanding its analytical potential beyond feasibility-driven practices. In this way, the present SLR contributes to deepening the use of SSR as a research methodology in mathematics education rather than simply broadening its application domains.

Despite these contributions to understanding the structure and direction of SSR research in mathematics education, several methodological limitations should be acknowledged. First, the literature search was limited to three databases—Dimensions, ERIC, and SINTA—which may not capture all relevant SSR studies, particularly unpublished works, theses, or studies indexed in other specialized databases, potentially introducing publication bias. Second, although this review was guided by the PICOS framework, the identification stage emphasized intervention and setting terms to maintain search sensitivity, while participant characteristics and outcome measures were mainly applied during screening rather than as explicit search keywords. Consequently, studies that employed single-case or single-subject designs in mathematics learning but did not explicitly label their methodology as "Single Subject Research" and provided limited methodological detail may have been overlooked during the screening process, despite full-text examination of potentially relevant records. Future SLRs are encouraged to expand database coverage and refine PICOS-based search strategies to deepen the methodological mapping of SSR in mathematics education, particularly with respect to research design rigor, participant diversity, and outcome targeting

CONCLUSION

This SLR study aims to answer five research questions related to SSR in mathematics learning in Indonesia. From these questions, it was found that the trend of SSR publications in mathematics learning in Indonesia tends to increase, peaking in 2023, despite fluctuations and declines in the last two years; the design is dominated by the ABA reversal type; it focuses more on the characteristics of subjects with sensory disabilities and at the special-needs school level; it uses a lot of number & operation material; it uses a lot of interventions in the form of learning media or technology; and most of them target specific mathematical skills. Based on these findings, further research is recommended to expand the application of SSR to more diverse topics and levels, using more complex designs such as multiple baselines, and exploring contextual interventions based on technology, project-based, and problem-based learning. This approach is important for developing higher-order thinking skills and holistic affective and behavioral aspects of students. For practitioners, these results can be used as a reference in designing adaptive and evidence-based individual interventions, while for policymakers, these findings emphasize the need to support inclusive education through policies, teacher training, and

the provision of resources that enable the sustainable implementation of SSR at various levels of education.

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