p-ISSN 2355-5343
e-ISSN 2502-4795
http://ejournal.upi.edu/index.php/mimbar

Article Received: 06/01/2024; Accepted: 11/02/2024
Mimbar Sekolah Dasar, Vol.11(2), 368-384
DOI: 10.53400/mimbar-sd.v11i2.71733

Mathematics Learning Research for Deaf Elementary School Students in Indonesia: A Systematic Literature Review

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Abstract. Mathematics education for deaf elementary school students is a crucial goal outlined in Article 31 of Indonesia's 1945 Constitution. Immediate and focused interventions are essential to support their mathematical education, a fundamental field for problem-solving in various aspects of life. This study involves a systematic literature review (SLR), examining the substance of multiple scholarly articles listed on Google Scholar and published across Indonesia from 2013 to 2022. Its primary focus is on different facets concerning the learning of mathematics for elementary school students who are deaf in Indonesia. While there hasn't been a notable upward trend in research studies focused on the learning of mathematics among deaf elementary school students over the past three years, it is revealed that the predominant research design is quantitative. The most researched material is "Numbers," and the commonly chosen instrument is "tests." Research locations are most frequently in Java, particularly East Java Province. Moreover, many studies highlight the central attention given to creating educational materials as a primary area of interest. These findings have led to the proposal of several suggestions for future research concerning the education of mathematics for deaf elementary school students in Indonesia, including the need to enhance research efforts in this area, explore more complex mathematical topics, and ensure a more equitable distribution of chosen research locations.

Keywords: Deaf; Elementary School; Mathematics Learning; Indonesia; SLR.

1. Introduction

The 1945 Constitution of the Republic of Indonesia enshrines the citizens' fundamental right to education in Article 31, Paragraph 1, affirming that "Every individual possesses the entitlement to education." This is reinforced by Article 31, Paragraph 2, declaring the government's commitment to a comprehensive national educational system (Idris et al., 2022; Santoso, 2021). As stated by (M. K. Siahaan, 2022; Topvoldiyevna, 2023), this signifies that every individual, irrespective of their socio-economic status, physical health, or mental well-being, is entitled to receive education. In simpler terms, children with disabilities possess an equal entitlement to educational opportunities (Alifulloh et al., 2023; Taneja-Johansson et al., 2023). Furthermore, the fulfillment of the rights of children with special needs is a crucial key to their effective growth and development (DeMatthews et al., 2020).

A specific category within the realm of children with special needs encompasses those with hearing impairments, commonly referred to as deaf children. Deafness represents a condition marked by the loss of hearing, resulting in the inability to perceive auditory stimuli effectively (Kolarik et al., 2021; Liu et al., 2020; Petit et al., 2022). The auditory deficit experienced by deaf children significantly hinders their cognitive development, culminating in various challenges that, in turn, contribute to diminished academic performance. This adverse impact extends to their achievements in subjects such as mathematics (Ma et al., 2021; S. Zhang et al., 2021).

The utilization of a Systematic Literature Review (SLR) is imperative to address the issue at hand due to several crucial reasons. Firstly, an SLR allows for a comprehensive examination of multiple scholarly articles pertaining to mathematics education for deaf elementary school students in Indonesia. This comprehensive approach ensures that all relevant research findings

are considered, providing a thorough understanding of the subject matter. Secondly, an SLR enables the identification of trends and patterns within the existing literature, such as prevalent research designs, commonly researched topics, and frequently chosen research locations. By recognizing these trends, researchers can gain valuable insights into the current state of research and areas requiring further exploration. Additionally, an SLR facilitates the synthesis of findings from diverse sources, allowing for a holistic view of the topic and the formulation of informed recommendations for future research endeavors (Paul et al., 2021). Overall, the systematic and rigorous approach of an SLR is essential for addressing the complexities of mathematics education for deaf elementary school students in Indonesia, ensuring that interventions and initiatives are grounded in evidence-based practices and contribute meaningfully to the advancement of the field.

1.1. Problem Statement

Mathematics is a fundamental academic discipline crucial for problem-solving in various life domains (Marchisio et al., 2022; Nakakoji & Wilson, 2020; Olivares et al., 2021). It is characterized by well-defined rules, a unique language, and a structured interplay of concepts (Dowling, 2020; Lavagnini et al., 2021). There is an agreement regarding the significance of early introduction to mathematics because of its crucial role in everyday living, including households, professional settings, and societal contexts (Bang et al., 2023; Solovieva et al., 2023; Ulwiyah et al., 2023; Vogt et al., 2020). Studies suggest that laying a robust groundwork in early mathematics is crucial for subsequent academic development (Wauters et al., 2023). Early exposure and instruction in mathematics are deemed more beneficial (Alam & Mohanty, 2023), providing advantages for children with special needs, including those with hearing impairments in elementary school.

The challenges posed by auditory limitations that impede the acquisition of mathematical skills necessitate the implementation of practical and purposeful learning activities, as well as the utilization of alternative sensory channels for message mediation. This adaptation is commonly denoted as specialized educational services (Maciej Serda et al., 2023). Likewise, regarding the education of deaf children in mathematics, the provision of specialized services is imperative to enhance their learning experience (Newhouse & Naraian, 2023; Paguirigan et al., 2023). To address this challenge, we need to examine the extent to which mathematics learning for deaf students in Indonesia has been explored so that we know which areas need improvement. The lack of research on mathematics learning for deaf students is still prevalent in Indonesia overall (Alifulloh et al., 2023). Therefore, an SLR study is needed to see how this trend occurs in a more specific segment, namely elementary schools.

In current conditions, effective strategies to improve mathematics education for elementary school students with hearing impairments need to involve the implementation of specific research dedicated to their mathematics learning. Studies by (Husniati et al., 2020; Langdon et al., 2023) emphasize the crucial nature of investigating math education for deaf individuals, given the unique challenges involved. This research not only provides an opportunity for scholars to develop educational materials and pedagogical techniques tailored to these challenges but also contributes to creating more comprehensive and meaningful learning experiences for the deaf elementary school students population. Furthermore, research on the math education of primary school deaf students has the potential to improve the general educational standards in Indonesia and expand their chances to reach their academic capabilities (Kelly et al., 2022; Tero et al., 2020).

1.2. Related Research

As of October 2023, only the study conducted by Alifulloh, Juandi & Hasanah (2023) has specifically scrutinized patterns in research regarding the education of deaf children in mathematics within accredited SINTA Kemendikbud journals in Indonesia. That research provides a comprehensive overview, spanning the entire education spectrum, from early childhood to higher education. This study, more focused than previous research, aims to collect information from diverse studies addressing mathematics learning for deaf elementary school students in Indonesia. The method includes analyzing the content of research discoveries in the

fields of mathematics education and special education published in Indonesia between 2013 and 2022.

In a more extensive context, a study conducted by (Andi, 2021) offered an overview of research in mathematics education in Indonesia, delving into trends observed in the field over the last seven years. The examination encompassed the analysis of 595 articles released from 2015 to March 2021, appearing in highly ranked journals chosen through the national database (Sinta). Employing mainly qualitative (41.85%), quantitative (32.94%), and developmental (17.82%) approaches, the study primarily involved junior high school students (35.63%). While key areas such as mathematical ability (27.23%), technology application (13.28%), and cognitive processes (9.92%) were emphasized, there remains limited exploration of certain domains, including the philosophy and history of mathematics education, early childhood mathematics learning, and issues associated with multiculturalism, multilingualism, and equity.

Apart from the aforementioned study, another investigation sharing a comparable conceptual framework with the present research is the one undertaken by Alifulloh et al. (2023). This particular study aimed to evaluate the range of research methods employed in the realm of biology education in Indonesia throughout the year 2017. Through the utilization of content analysis, a total of 122 articles underwent scrutiny, revealing that the most commonly employed methods included Research and Development (R&D), Quasi-experimental designs, media/learning sources, questionnaires, frequency and percentage analyses, with a particular focus on senior high school subjects. These findings underscore the importance for researchers to judiciously select suitable methods, considering the diverse approaches, designs, and techniques evident in educational research on biology in Indonesia.

However, this research differs from previous investigations, particularly regarding the learning of mathematics for deaf children in several key aspects. Firstly, its focus is on scrutinizing all articles encompassed within the Google Scholar database, published in Indonesia from 2013 to 2022. Secondly, its objective is to explore a selection of articles related to mathematics learning, with a specific emphasis on deaf elementary school students in Indonesia. Lastly, the analysis of content is built upon several foundational parameters.

1.3. Research Objectives

This research seeks to comprehensively address the following questions: (1) How has the volume of research dedicated to the mathematics education of deaf elementary school students in Indonesia changed over time? (2) What are the diverse research methodologies applied in investigations regarding mathematics education for deaf elementary school students in Indonesia? (3) Which themes are most frequently encountered in research on mathematics education for deaf elementary school students in Indonesia? (4) What tools and methodologies do researchers commonly employ in their examinations of mathematics education for deaf elementary school students in Indonesia? (5) Which specific geographical regions are predominantly featured in research related to mathematics education for deaf elementary school students in Indonesia? (6) What constitutes the primary focus of scholarly investigations conducted in the field of mathematics education for deaf elementary school students in Indonesia?.

2. Theoretical Framework

2.1. Deaf Students

Deaf students, also known as students with hearing impairments, constitute a unique group in the educational landscape. Their learning experiences are distinctive due to their communication needs and the challenges they encounter in the academic environment (Mayer et al., 2023). Educational theories have emphasized the significance of inclusive practices and tailored approaches to accommodate the diverse needs of these students (Mitchell & Sutherland, 2020). According to the ecological systems theory proposed by Bronfenbrenner, understanding a deaf student's development involves recognizing the impact of various systems - microsystem, mesosystem, exosystem, and macrosystem - that influence

their learning process (Fulantelli et al., 2021). This theory underscores the importance of considering not only the immediate educational setting (microsystem) but also the interactions between school, family, community, and societal structures (meso, exo, and macrosystems) in facilitating the holistic development of deaf students (Leigh et al., 2022).

Deaf students, constituting a unique subset within educational settings, require specialized attention and tailored learning approaches due to their distinct communication needs. The use of multimedia learning tools has emerged as a promising avenue in facilitating effective education for deaf students. The Cognitive Load Theory, as proposed by O. Chen et al. (2023) provides a framework for understanding the mental processes involved in learning. Applying this theory to the use of multimedia tools for deaf students suggests that visual aids, animations, and interactive content can help reduce cognitive load by presenting information in multiple modalities, making it more accessible and comprehensible (Ahmad & Khasawneh, 2023). Research conducted by (Adnyani et al., 2021) indicates that multimedia-based learning enhances the engagement and understanding of deaf students by providing visual and textual representations that supplement auditory information. Moreover, leveraging multimedia resources aligns with the principles of Universal Design for Learning (UDL), which advocates for diverse instructional methods to accommodate varied learning needs (L. Zhang et al., 2022). Integrating multimedia into the curriculum ensures greater inclusivity and flexibility in catering to the learning preferences and capabilities of deaf students, fostering an environment conducive to their educational advancement(Campado et al., 2023).

2.2. Mathematics Learning for Deaf

Mathematics learning holds paramount importance for students with special needs, particularly those who are deaf or hard of hearing. The incorporation of multisensory approaches in mathematics education emerges as a critical avenue to facilitate effective learning experiences for this demographic (L. Chen & Wang, 2021; Santos & Cordes, 2021). The Multisensory Math Instruction (MMI) method offers a promising framework by integrating visual, tactile, and auditory modalities in teaching mathematical concepts. Research by Alshammari et al. (2022) underscores the efficacy of MMI in enhancing the mathematical understanding of deaf students, as it allows them to engage with math concepts through multiple sensory channels, compensating for potential sensory deficits. By employing MMI techniques, educators can create a rich learning environment that accommodates various learning styles, ensuring equitable access to mathematical knowledge for deaf students (Caruso et al., 2021).

Additionally, the Theory of Constructivism in mathematics education advocates for active learning experiences where students construct their understanding of mathematical concepts through exploration and problem-solving (Lombardi et al., 2021). This theory is particularly pertinent for deaf students as it emphasizes hands-on learning, manipulatives, and real-world applications to foster deeper comprehension. Studies by Abiatal & Howard (2020) highlight the effectiveness of constructivist approaches in mathematics instruction for deaf learners, demonstrating improved mathematical reasoning and problem-solving skills. By employing constructivist strategies, educators can encourage active engagement, critical thinking, and the application of mathematical concepts in practical scenarios, thereby enhancing the mathematical abilities of deaf students (Nunes, 2020).

Moreover, the importance of early mathematical intervention cannot be overstated for deaf students. Early exposure to foundational mathematical concepts plays a pivotal role in shaping their mathematical skills and confidence. Research by Payne (2024) emphasizes the significance of early math interventions tailored to the unique learning needs of deaf children, indicating that timely and targeted support positively impacts their mathematical development. Implementing specialized early intervention programs that focus on foundational math skills can bridge learning gaps and provide a solid mathematical groundwork for deaf students, enabling them to progress more effectively in their mathematical education (Thom & Hallenbeck, 2022).

2.3. Systematics Literature Review

Systematic Literature Review (SLR) studies play a crucial role in educational research, providing a comprehensive and rigorous approach to synthesizing existing literature on a specific topic. By systematically gathering, analyzing, and synthesizing relevant scholarly articles, SLR studies enable researchers to identify trends, gaps, and areas for further investigation within the realm of education (Naveed et al., 2023). Through the meticulous examination of a wide range of sources, including peer-reviewed journals, conference proceedings, and academic publications, SLR studies offer valuable insights into the current state of knowledge and highlight emerging trends and best practices (Talwar et al., 2021). Additionally, SLR studies help inform evidence-based decision-making in educational policy and practice by providing a solid foundation of empirical evidence and scholarly discourse (Boaye Belle & Zhao, 2023). Ultimately, by fostering a deeper understanding of educational issues and facilitating the dissemination of research findings, SLR studies contribute significantly to advancing the field of education and promoting continuous improvement in teaching and learning practices (Adni et al., 2023).

3. Method

3.1. Research Design

This research used classified as a Systematic Literature Review (SLR), which is a survey-based quantitative descriptive approach. Adheres to the content analysis principle and seeks to examine results obtained from various research efforts published in academic journals and university databases in Indonesia, as indexed by Google Scholar. SLR serves as a methodology for locating, choosing, and appraising pertinent research, in addition to gathering and scrutinizing data from research for articulation in a scientifically structured and explicit manner (Juandi, 2021). It provides various advantages that may motivate researchers to undertake subsequent studies, drawing upon the insights delineated in antecedent publications (Akrami et al., 2023). To maintain the standard of the review procedure, the Systematic Literature Review employed by Alifulloh et al. (2023) has been adopted as the methodology for this study.

3.2. Data Collection

The information utilized in this study was gathered through the examination of articles within the fields of Mathematics Education and Special Education. All articles originated from research within these specific domains, available via Google Scholar. The methodology involved the use of the Publish or Perish 8 software and the application of specific criteria: (1) The research was conducted between 2013 and 2022. (2) The study was conducted within the territory of Indonesia. (3) The research concentrated on the teaching of mathematics to deaf students at the elementary school level. (4) The research identified the specific mathematical subjects investigated. Using the keywords "Mathematics and Deaf," 42 relevant articles were found, and after applying more specific criteria, this study analyzed and reviewed a total of 20 selected articles.

To align with the research objectives, it is essential to employ an instrument or inclusion criteria (Alifulloh et al., 2023). This study utilizes a content analysis guideline as the instrument, encompassing specific observed aspects detailed in Table 1. The content analysis examines six primary aspects: (1) yearly publication count, (2) research type, (3) selected mathematical topics, (4) data collection instrument, (5) research location (provinces in Indonesia), and (6) research focus. Notably, predetermined categories were not initially established for aspects (1) and (6) due to a lack of prior studies as references. Meanwhile, the classifications for components (2), (3), and (4) were established in advance prior to gathering the data, adapted from Alifulloh et al. (2023).

Table 1. Aspects and Categories

Aspects	Categories	
Types of Research (2)	T.1- R and D T.2- CAR	T.4- Quantitative Research T.5- Mix Method

	T.3- Qualitative Research	
Mathematical Topics (3)	M.1- Numbers M.2- Algebra	M.3- Geometry M.4- Statistics & Probability
Data Collection Instruments (4)	I.1- Questionnaire I.2- Documentation I.3- Test	I.4- Interview I.5- Observation

3.3. Data Analysis

The literature analysis involves meticulous attention to discovered data. This review process has been carried out throughout October 2023. Each examined article is classified according to predefined criteria, drawing on information from abstracts, methods, and discussions presented by the authors. Collected data undergoes analysis using data processing software, specifically Microsoft Excel. The processed results are visually depicted through tables and line charts, capturing emerging trends in each reviewed category within the captions. This method ensures a comprehensive understanding of the literature, emphasizing categorization and visual representation for effective analysis of trends within the examined articles (Juandi, 2021).

4. Findings

4.1. Number of Publications

The frequency of publications signifies the frequency of research conducted during a particular timeframe. Based on an examination of the years in which research was conducted in 20 studies chosen specifically regarding the education of mathematics for elementary school students who are deaf in Indonesia. In general, there is consistently research conducted every year regarding mathematics learning for deaf elementary school students in Indonesia. Looking at the number of studies over the past 10 years, 2019 stands out as the year with the most common occurrence of studies concerning the education of mathematics for deaf elementary school students in Indonesia. More detailed information about the number of studies each year can be seen in the following graph:

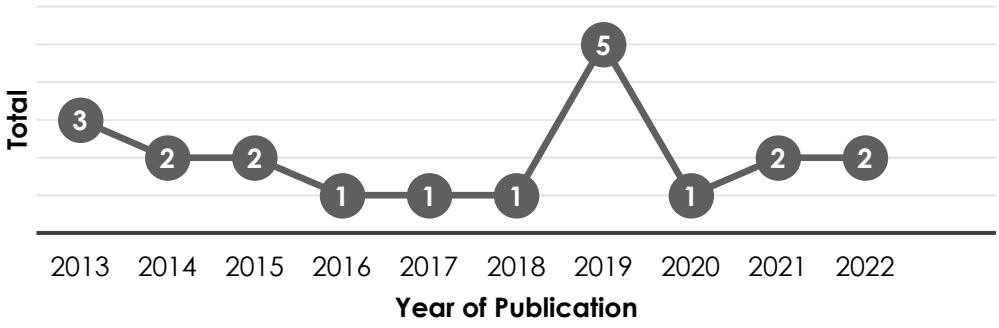

Figure 1. Number of Research from 2013 to 2022

4.2. Types of Research

Based on the findings concerning the types of research conducted on Mathematics Learning for Deaf Elementary School Students in Indonesia, there is a variation in the methodologies applied. Out of a total of 20 selected studies, it is evident that quantitative research designs dominate, comprising 13 studies. This quantitative method serves as the primary approach in investigating the subject of mathematics learning for deaf elementary school students in Indonesia. Additionally, there is also the utilization of Research and Development (R&D), Collaborative Action Research (CAR), Qualitative Method, and Mix Method, which can be detailedly observed in the following graph:

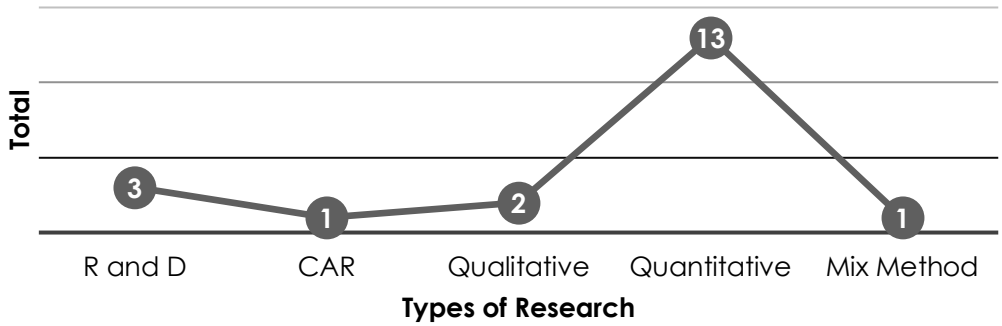

Figure 2. Research Types

4.3. Mathematical Topic

Mathematics, as a subject, encompasses a wide array of topics, including numbers, geometry, algebra, and statistics and probability, as categorized by TIMSS standards (Al-Saadi & Al-Kinani, 2021; Brahier, 2020). Analyzing the trends in Mathematics Learning for Deaf Elementary School Students in Indonesia over the past 10 years reveals significant disparities in exploring different mathematical topics. Among the selected studies, numbers emerged as the primary focus, constituting 19 research endeavors. Conversely, there is a noticeable absence of research dedicated to Algebra, Statistics & Probability, with zero studies recorded. Geometry, on the other hand, received minimal attention with only one study devoted to this mathematical subject. Further details can be seen in the following graph:

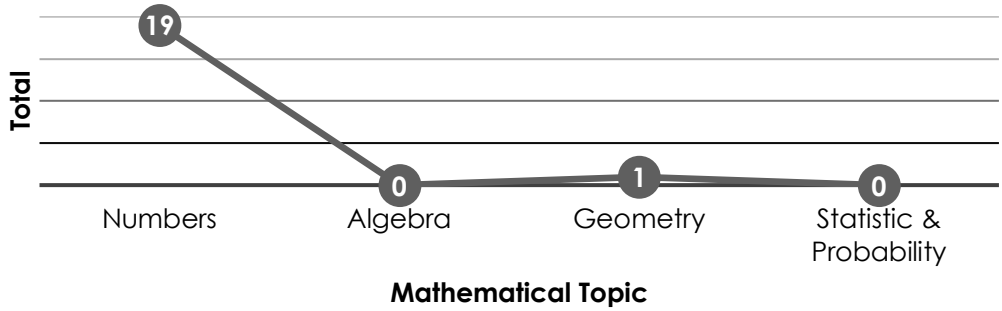

Figure 3. Mathematical Topics Explored

Content analysis was also conducted to further explore the researched mathematics topics. Specifically, within the realm of numbers, studies have investigated various aspects, such as Whole Numbers, which were the focus of 8 investigations, followed by Integers with 3 studies, and Fractions, explored in 5 studies. Additionally, Time Numbers and Roman Numerals were each the subject of 1 study. Unexpectedly, Algebra and Statistics & Probability did not receive attention within the context of mathematics learning for deaf elementary school students in Indonesia during this period. Conversely, Geometry was the subject of one research study, specifically centered on Plane Figures. Further details are presented in the following Table 2:

Tabel 2. Mathematical Topic Details.

Topics		Frequency	
Numbers	Whole Numbers	8	19
	Integers	3	
	Fractions	5	
	Time Numbers	1	
	Roman Numeral	1	
	Ratio	1	
Geometry	Plane figure	1	1
Total		20	20

4.4. Data Collection Instruments

In studies focused on crafting mathematics instructional materials for primary school students with hearing impairments, researchers utilize diverse tools for gathering data. Multiple instruments may be utilized within a single study (AL-Ali & Marks, 2022; Marks & Al-Ali, 2022). Figure 4 depicts that assessments are the predominant tool utilized for gathering data in studies focused on the education of mathematics for deaf elementary school students. This corresponds to common research methodologies such as Quantitative and Research and Development (R&D), which integrate assessments as a fundamental data collection method. Moreover, employing assessments for data collection is perceived as more objective compared to utilizing questionnaires and observations. Additional details can be observed in the subsequent Figure 4:

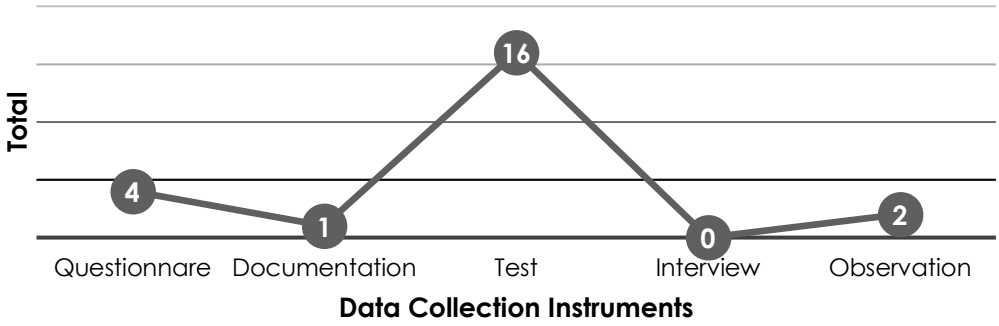

Figure 4. Instruments Used in Research

4.5. Research Location

The choice of research location is a crucial factor impacting study outcomes. A well-selected location enhances the validity and generalizability of findings, facilitating the collection of necessary data. Researchers should consider factors like accessibility, representativeness, safety, and facility availability to align the research location with study objectives effectively.

Table 3 showcases the distribution of research based on their respective locations in Indonesia. The research locations were categorized based on islands and provinces. The data indicates that among the islands, Java stands out as the most extensively researched area, comprising 17 out of the total 20 studies. Within Java, East Java led with 10 studies, followed by West Java with 4 studies and Yogyakarta with 3 studies. Meanwhile, other major islands such as Sumatera, Bali & Nusa Tenggara, and Sulawesi each had a single study conducted in West Sumatera, NTB (Bali & Nusa Tenggara), and South Sulawesi, respectively.

Table 3. Distribution of the Number of Research Based on Research Locations.

Island	Province	Frequency	Total
Sumatera	West Sumatera	1	1
Java	West Java	4	17
	East Java	10	
	Yogyakarta	3	
Bali & Nusa Tenggara	NTB	1	1
Sulawesi	South Sulawesi	1	1
Total		20	20

4.6. Research Focus

A pivotal aspect of the research process involves defining the research focus. This step holds immense importance in comprehensively understanding various subjects and occurrences across different study domains, emphasizing the particular facets to be investigated (AKYILDIZ

& AHMED, 2021; Isaksson et al., 2020). The research focus acts as the principal compass for researchers, steering them toward attaining optimal and relevant results that correspond with the intended research goals. Within the domain of mathematics education research, numerous research focuses are available for exploration to enrich the understanding of mathematics learning and teaching.

The summary of the research emphasis in teaching Mathematics to Deaf Elementary School Students in Indonesia can be found in Table 4. The table exhibits the varying research concentrations over the last period. Among the identified research foci, Learning Models were the most frequently explored, constituting 6 out of 20 studies. Following this, the Use of Learning Media was the focus of 7 studies, signifying a considerable emphasis on investigating the role of instructional tools or materials in facilitating mathematics learning for deaf elementary school students. Additionally, Learning Approaches were explored in 3 studies, while Learning Design and Development of Learning Media were each the subject of 1 or 2 studies, respectively.

Table 4. Distribution of Research Focus

No.	Research Focus	Frequency
1	Learning Design	1
2	Learning Methods	1
3	Learning Models	6
4	Learning Approaches	3
5	Use of Learning Media	7
6	Development of Learning Media	2
Total		20

5. Discussion

According to the data depicted in Figure 1, articles addressing mathematics learning for deaf elementary school students in Indonesia are available spanning from 2013 to 2022. There isn't a discernible consistent trend evident in the quantity of research studies conducted annually. Nevertheless, referencing Figure 1 indicates a notable surge in research articles during 2019 compared to prior years. However, this figure subsequently declined in the succeeding years. The graph representing the quantity of research studies on mathematics learning for deaf elementary school students in Indonesia indicates a restricted number of researchers exploring this particular field.

Research is often driven by the researchers' concern for educational equality for children with special needs, an issue emphasized in the government constitution (Collective*, 2023). The insufficient focus on mathematics learning for deaf children is a prominent problem, with learning frequently treated as a mere obligation without accompanying research-based efforts to enhance its quality. Therefore, undertaking research is regarded as the most efficient method to tackle this problem (Dawadi et al., 2021; Gray, 2021).

Afterwards, the selection of research methodology has a significant impact on the research focus. As depicted in Figure 2, researchers studying mathematics learning for deaf elementary school students in Indonesia primarily utilize quantitative research designs. This predominance of quantitative research aligns with earlier discoveries within the realm of education, where researchers have often exhibited a preference for quantitative designs over qualitative ones (Mohajan, 2020; Uzunboylu & Aşıksoy, 2014). The graph underscores that research in this domain is primarily characterized by a prevalence of quantitative studies, although alternative methodologies are also employed.

Furthermore, research and development (R&D) approach is frequently employed in educational research (Ramot & Bialik, 2023). Developmental research stands out as a prominent trend in educational research in Indonesia. In this research methodology, academics commonly create educational materials stemming from their previous findings and

developmental processes. These materials could encompass books, modules, or instructional resources (Inarda, 2023; Lukin et al., 2022). In this study, R&D also emerges as an alternative research type.

An analysis of chosen research articles indicates that there is a restricted scope in investigating mathematical subjects, covering only a fraction of these subject groups. Figure 3 illustrates that out of the total studies, 19 specifically concentrate on numbers, emerging as the most frequently studied topic in the context of mathematics learning for deaf elementary school students in Indonesia. Conversely, the absence of research on algebra, statistics, and probability in the same context can be attributed to the inherent difficulty of these subjects, which are not part of the designated curriculum for mathematics in deaf elementary schools in Indonesia. Consequently, algebra, statistics and probability stands out as the least investigated topic. This aligns with (Hord & DeJarnette, 2020; Van den Heuvel-Panhuizen & Drijvers, 2020), affirming that algebra, as an abstract mathematical concept, poses challenges for learners, and topics such as statistics and probability are inherently complex in the realm of mathematics.

Next, based on the data presented in Figure 4 over the past 10 years, it is evident that research focusing on mathematics learning for deaf elementary school students in Indonesia predominantly relies on tests as the primary method of data collection, constituting a total of 16 studies. Moreover, questionnaire instruments were notably utilized, with 4 studies employing this approach. Conversely, the utilization of documentation and observation instruments was comparatively lower, each being employed in only 1 and 2 studies, respectively. Surprisingly, the interview method was not utilized in any of the studies analyzed during this period. These findings highlight the prevalence of test-based data collection methods in research concerning mathematics learning for deaf elementary school students in Indonesia, while other methods exhibit a more restricted or absent usage.

Furthermore, the data provided in Table 3 reveals a significant discrepancy in research distribution across different provinces and islands in Indonesia concerning mathematics learning for deaf elementary school students. The higher number of studies concentrated in Java, particularly East Java, West Java, and Yogyakarta, suggests a potential disparity in research focus and attention among regions. This concentration may reflect a higher prevalence of resources, academic institutions, or initiatives supporting research in these areas compared to other provinces (Huda S. A. et al., 2021; E. Y. S. Siahaan et al., 2023). However, it also raises questions about the representation and inclusivity of research outcomes in addressing the needs of deaf elementary school students across diverse geographical regions in Indonesia (Alifulloh et al., 2023). The disparity in research distribution emphasizes the importance of fostering research initiatives and resources in underrepresented provinces to ensure a more comprehensive understanding and improvement of mathematics learning for deaf students throughout the country.

Subsequently, the distribution of research focus within the domain of Mathematics Learning for Deaf Elementary School Students in Indonesia presents an intriguing trend. The predominant investigation into Learning Models indicates a significant interest in exploring varied approaches or frameworks that can effectively deliver mathematical concepts to deaf students (Paolo et al., 2023). Moreover, the substantial attention given to the Use of Learning Media reflects a growing recognition of the impact and potential of instructional aids in enhancing the learning experiences of deaf students in mathematics education (Andriyani & Buliali, 2021). However, the limited exploration of Learning Design and Development of Learning Media suggests a potential area for further research to develop and refine pedagogical strategies and educational materials tailored to the unique needs of deaf students in mathematics learning. This distribution reveals the evolving landscape of research endeavors, emphasizing the importance of diverse approaches and resources in fostering effective mathematics education for deaf elementary school students in Indonesia.

However, SLR in research entails both advantages and drawbacks. One significant limitation lies in its potential to miss recent developments or emerging perspectives due to its focus on articles published within a specific timeframe, which may compromise the comprehensiveness of the findings. Additionally, the reliance on published literature may introduce publication bias, such as only taking articles that have been published by indexed publishers and excluding articles outside of that, leading to a skewed representation of the research landscape. On the other hand, SLR offers notable strengths. By systematically synthesizing existing knowledge, it provides a comprehensive overview of the topic of mathematics learning research for deaf elementary school students, enabling researchers to identify trends, gaps, and inconsistencies in the literature. Furthermore, its rigorous methodology enhances the reliability and credibility of the findings, making SLR a valuable tool for informing evidence-based decision-making and guiding future research directions (Mohamed Shaffril et al., 2021).

6. Conclusion

This study involved the review of articles centered around mathematics learning for deaf elementary school students in Indonesia, published in Google Scholar-indexed journals from 2013 to 2022. Interestingly, there was no discernible trend indicating a significant increase in the number of studies focusing on mathematics learning for deaf elementary school students in Indonesia over the last three years. Amidst the plethora of publications, it was observed that quantitative research emerged as the prevailing research method. Notably, the topic "Numbers" was recurrently chosen, and tests were identified as the most frequently employed data collection tool. In terms of location, Java Island, specifically East Java Province, emerged as the primary site for studies on the education of mathematics for deaf elementary school students in Indonesia. Additionally, the utilization of instructional media surfaced as the most extensively studied area within the analyzed articles.

Limitation

This study is limited to research conducted in Indonesia spanning from 2013 to 2022, retrieved through searches using the Publish or Perish 8 software, specifically selecting articles indexed in Google Scholar. Due to constraints related to journal page limitations, the study process was abbreviated.

Recommendation

Drawing insights from this study, a range of recommendations can be put forth to guide future research endeavors. Primarily, fostering collaborative initiatives is imperative to enhance the frequency of investigations into mathematics learning for deaf elementary school students in Indonesia, with a specific focus on broadening research methodologies beyond quantitative methods. Secondly, there is a call for an expansive examination of the nuanced scope of mathematical topics, specifically delving into pedagogical methods suitable for deaf elementary school students. Thirdly, scholars are urged to provide thorough descriptions of their research tools, including evaluations of their validity and reliability. Finally, it is recommended that forthcoming research on mathematics education for deaf elementary school students should encompass additional regions within Indonesia, specifically in the eastern part, to ensure a more balanced depiction of educational practice for deaf students across the country.

Acknowledgments

To all parties who have provided invaluable assistance in preparing this article, including the Lembaga Pengelola Dana Pendidikan (LPDP), Pusat Layanan Pembiayaan Pendidikan (PUSLAPDIK), and Beasiswa Pendidikan Indonesia (BPI), your support has been invaluable. It is hoped that this article will be beneficial to everyone and that it receives constructive feedback and suggestions for further enhancements.

Conflict of Interest

The Authors affirms that there are no competing interests associated with this study.

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