

# THE NUMERACY LITERACY SKILLS OF VISUALLY IMPAIRED STUDENTS

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## ABSTRACT

*This study aims to analyze various studies on the numeracy literacy of blind students using the *Systematic Literature Review* (SLR) approach. The articles analyzed were selected based on inclusion criteria in the form of relevant research in the period 2017–2024, as well as exclusion criteria that include research that is not empirically based or does not focus on blind students. The analysis was conducted using a thematic synthesis approach to group the main findings from the reviewed literature. The results of the study indicate that the numeracy literacy skills of blind students are still below national education standards. The main difficulties they face lie in understanding abstract mathematical concepts, limited access to adaptive learning media, and lack of pedagogical support that suits their needs. Learning strategies that have been proven effective include the use of tactile methods such as jarimatika and braille media, technology-based approaches such as flipped classrooms and digital applications, and contextual learning that involves direct experience. Internal factors such as learning styles and motivation, as well as external factors such as teacher training and environmental support, greatly influence the achievement of numeracy literacy in blind students. This study shows the importance of a systematic and evidence-based approach in developing learning strategies for blind students. Therefore, increasing the accessibility of learning media and training for educators are important steps to create a more inclusive and effective learning environment.*



## A. INTRODUCTION

Numeracy Numeracy literacy is a crucial 21st-century skill that reflects an individual's mastery of basic mathematical concepts and their application in everyday life. This competency extends beyond mere arithmetic skills; it encompasses reasoning, problem-solving, and the ability to interpret numerical information across diverse contexts (OECD, 2021).

Etymologically, the term “literacy” originates from the English word literacy, which refers to the ability to read and write (Hakim et al., 2023). Among the various types of literacy, numeracy literacy presents one of the greatest challenges for students. It not only involves understanding numbers and mathematical symbols but also the skills of listening, speaking, reading, and writing to acquire and communicate knowledge effectively (Fauzanah et al., 2024). More broadly, numeracy refers to the capacity to apply mathematical concepts and skills in real-life situations and to comprehend and interpret

numerical data within one’s environment (Sani, 2021).

Numeracy literacy comprises three core components: basic arithmetic, numerical relations, and arithmetic operations (Nastiti et al., 2022). It enables individuals to engage with numbers and mathematical symbols, analyze information presented in various forms (e.g., charts, tables, and graphs), and understand, interpret, and explain data logically (Kemendikbud, 2017 in Putri & Wijayanti, 2024). Moreover, it includes the ability to represent mathematical problems, use appropriate mathematical symbols, interpret word problems, and select suitable problem-solving strategies (Salvia et al., 2022).

This competency plays a pivotal role in fostering logical and critical thinking. Mathematics is not solely about formulas; it requires reasoning and structured thinking to address contextual problems. Thus, numeracy literacy supports students in recognizing the relevance of mathematics in solving real-world issues (Salvia et al., 2022). The National

Literacy Movement Team (2017) emphasized numeracy literacy as a key 21st-century competence that strengthens basic conceptual understanding and helps individuals manage everyday situations involving numbers and mathematical information (Putri & Wijayanti, 2024). Furthermore, it trains individuals to become critical thinkers who approach problem-solving and decision-making in a systematic and rational manner (Puspaningtyas & Ulfa, 2020).

Although numeracy literacy is embedded in mathematics instruction at school, not all instructional content is designed to foster this ability. Therefore, learning materials and mathematical problems should be intentionally structured to stimulate cognitive engagement, encourage exploration of mathematical ideas, enhance reasoning, and promote creativity in developing effective problem-solving strategies (Ratnasari, 2020). For this reason, strengthening numeracy literacy is a national educational priority, particularly for students with special needs.

Students with special needs, particularly those who are blind or visually impaired, face more complex challenges in developing numeracy literacy. Visual limitations hinder their access to standard visual learning materials, such as diagrams, charts, and mathematical symbols (Izza & Sehli, 2023). In addition, a lack of accessible teaching materials, insufficient teacher training in inclusive education, and inadequate policy support present systemic obstacles to developing numeracy skills among blind students (Kemendikbudristek, 2023).

Literacy and numeracy are foundational competencies that every individual must acquire to navigate daily life. While literacy includes reading, writing, and understanding information, numeracy entails the comprehension and application of mathematical concepts in real-world contexts (OECD, 2021). For students with disabilities, the development of these skills is often hindered by cognitive, sensory, or motor limitations (UNESCO, 2020).

Data from the 2021 Programme for International Student Assessment (PISA) reveal that literacy and numeracy skills among Indonesian students, including those with special needs, remain below international standards (OECD, 2021). These students often struggle to comprehend reading texts,

solve word problems, and connect numerical concepts with real-life situations. Contributing factors include rigid teaching methods, the lack of appropriate learning resources, and limited teacher training (Kemendikbudristek, 2023).

Furthermore, the 2023 report by the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) found that approximately 65% of students with special needs in inclusive schools still fall below the minimum standard for literacy and numeracy. This issue is exacerbated by the scarcity of specially designed learning materials—such as Braille or audio-based tools for blind students and visual-based materials for deaf students. As a result, many students with special needs struggle to meet the competencies outlined in the national curriculum.

Blind students, in particular, face distinct challenges in developing numeracy literacy. Visual impairments hinder their ability to read and write, locate and access information, and comprehend complex letters and numbers (Izza & Sehli, 2023). Additionally, prevailing societal stigma often underestimates their academic potential, thereby reducing motivation and access to literacy and numeracy instruction (Triwiaty, 2017).

Adaptive and technology-based teaching approaches offer promising strategies to address these challenges. Research has shown that interactive multimedia, artificial intelligence (AI), and project-based learning can enhance students' understanding of numeracy literacy (Sharma et al., 2022). However, implementation remains limited due to barriers such as unequal access to technology and insufficient teacher training (Anderson & Johnson, 2021). For instance, Rindiani and Irdamurni (2019) found that using the "Blokjes" media improved addition operation skills in blind students. In contrast, a study by Rohmatul et al. (2024) reported that blind students continued to face significant difficulties with basic operations such as addition and subtraction, primarily due to challenges in grasping abstract concepts—even when assisted by tactile tools like "Jarimatika."

The urgency of this study lies in the lack of comprehensive research focusing specifically on the development of numeracy literacy among blind students. While numerous studies have examined students with special needs in general, very few have

investigated the strategies, challenges, and learning media tailored to the unique needs of blind learners.

Moreover, no prior research has employed a Systematic Literature Review (SLR) approach to synthesize and categorize studies related to numeracy instruction for blind students. This gap highlights the novelty of the present study, which aims to not only compile prior findings but also provide a thematic synthesis of effective strategies, supporting and inhibiting factors, and actionable recommendations for strengthening numeracy literacy in this population.

Therefore, this study is expected to contribute significantly to both academic discourse and practical efforts in advancing inclusive education—particularly in curriculum planning, instructional media development, and teacher professional development. Through the SLR approach, this research seeks to offer evidence-based recommendations to improve numeracy literacy among blind students in a meaningful and sustainable way.

## B. METHODS

This study This study adopts a qualitative research approach using the Systematic Literature Review (SLR) method, aiming to examine the numeracy literacy skills of blind students. The SLR method involves several stages: identification, review or analysis, evaluation, interpretation, and drawing conclusions based on relevant and topic-aligned research findings. The literature is collected systematically and in a structured manner, following specific steps to address the defined research problem (Triandini et al., 2019).

The data used in this study are secondary data obtained indirectly from previous research published in academic journals. The SLR process consists of the following steps: (1) Planning, where the researcher formulates the research steps and defines the research question; (2) Selection, in which relevant studies are chosen from the pool of potential literature; (3) Documentation, where findings from the selected studies are recorded and described; (4) Conclusion, where the researcher summarizes the findings comprehensively as the basis for answering the research question (Febriatama, 2023).

The steps undertaken in the SLR process of this study are as follows:

### 1. Identification and Topic Formulation

The researcher formulated the research question: "How are the numeracy literacy skills of blind students characterized based on previous studies?" The focus was directed toward learning strategies, challenges, and the effectiveness of numeracy approaches for blind students.

### 2. Literature Search

Articles were retrieved from three major databases: Google Scholar, Garuda, and SINTA. The keywords used included: "numeracy literacy of blind students," "mathematics learning for blind students," and "mathematical literacy of students with special needs."

### 3. Study Selection

a) Inclusion Criteria: Empirical studies published between 2017 and 2024, focusing on blind students or students with special needs in the field of numeracy.

b) Exclusion Criteria: Conceptual articles lacking empirical data, and studies not focusing on blind students.

### 4. Data Exploration and Documentation

Selected articles were recorded in a tabular format, including the following information: author(s), year, study title, and key findings.

### 5. Thematic Analysis and Synthesis

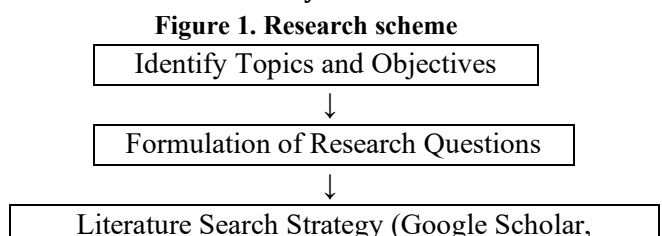
The researcher grouped the findings based on themes such as: levels of numeracy skills, instructional strategies, supporting and inhibiting factors, and educational innovations.

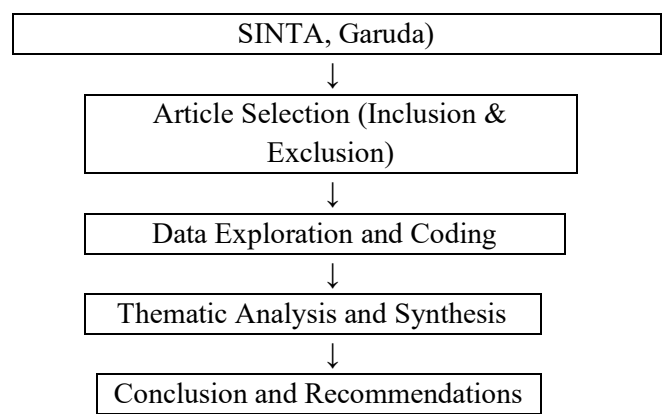
### 6. Conclusion Formulation

Based on the thematic analysis, conclusions and recommendations were formulated to support the development of effective numeracy learning practices for blind students.

A total of 12 articles were included in this study after passing the selection process based on the criteria mentioned above.

The following figure presents the SLR process scheme used in this study:





C. RESULTS AND DISCUSSION

Based on the search results, there are 12 articles that are the subject of the review. The following are the identities of the articles.

Table 1. Search Results Related to Numeracy Literacy Articles

No.	Writer	Research Title	Research result
1	Ina Rohmatul, et al (2024)	Dynamics of Difficulties in Finger Arithmetic Counting in Blind Students at SLB. A, B, D Negeri Kedungka ndang	The results of the study showed that blind students experienced significant difficulties in basic arithmetic operations such as addition and subtraction, which were influenced by limitations in understanding abstract concepts. The jarimatika method shows potential as a concrete approach to support mastery of the sense of touch, but requires strengthening the understanding of basic mathematical concepts so that students do not only rely on assistive devices.
2.	The Beautiful Grace of Panglipur (2023)	ANALYSIS OF LEARNING STYLE AND MATHEMATICAL LITERACY ABILITY WITH	Learning styles in blind people are auditory and kinesthetic learning styles. Based on the results of observations that have been confirmed properly and accurately using

		DISABILIT IES IN VISIBLE STUDENTS	unstructured interview techniques. Meanwhile, the mathematical literacy skills of blind people are still not good because they only meet one of the indicators of the problem formulation
3.	Danuri et al., (2023)	Mathemati cal Literacy Reviewed From Mathemati cal Represent ation In ABK At Tamansari 1 Inclusive Elementar y School Yogyakarta a	Factors that influence the decline in mathematical literacy skills are internal and external factors. Obstacles experienced by students who are classified as special needs children in representing mathematical literacy such as: Children have difficulty understanding mathematical literacy in class, Children have difficulty memorizing mathematical formulas, Solutions provided by teachers such as facilitating children with special needs in schools by mixing children with special needs with other children and each child is given the same opportunity to participate
4.	Ida Ermiana, et al (2021)	Numeracy Literacy Skills of Inclusive Elementar y School Students in Solving Story Problems	The results of this study indicate that the numeracy literacy skills of inclusive students are still considered low.
5.	Iranda, D., and Sari, M. (2023)	Informatio n Literacy Skills in Blind Students	This study found that blind students at SLB Prof. Sri Soedewi Jambi have good information literacy skills, including the ability to read, write, count, and access

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|    |                            |   | information via the internet. They also utilize special literacy facilities for the blind.   |     | the results of the study, it was found that Blokjes media can improve the ability of downward series addition arithmetic operations in blind children to increase.   |
| 6. | Rina Marlina (2022)        | Campus Teaching Batch 4 and Improving Numeracy Literacy of Students with Special Needs                                  | The Campus Teaching Program is effective in improving the numeracy literacy of students with special needs in elementary schools.  | 11. | The Story of Nurul Hidayah (2020)  |
| 7. | The Last Supper (2017)     | Mathematical Literacy Reviewed from Mathematical Reasoning in Children with Special Needs at Siyono I Elementary School | Children with special needs at Siyono I Elementary School demonstrate mathematical literacy abilities that are influenced by their level of mathematical reasoning.  |     | Implement of Literacy Movement For Children With Special Needs In Inclusive Schools  |
| 8. | Siti Aminah (2021)         | Mathematical Literacy Skills Through Flipped Classroom Learning in Special Schools                                      | Flipped classroom learning is effective in improving students' mathematical literacy in Special Schools.   | 12. | Rumantini ngsih et al., (2020)   |
| 9. | Ahmad Fauzi (2018)         | Students' Numeracy Literacy Skills in Inclusive Elementary Schools  | Students at inclusive elementary schools showed an increase in numeracy literacy skills after implementing learning methods adapted to the needs of children with special needs.   |     | Overcoming Difficulties In Learning Mathematics In Blind Students Through The Development Of Braille Coded Pandikar Media  |
| 10 | Rindiani, Irdamurni (2019) | Blokjes Media to Improve the Arithmetic Operation Skills of Blind Children"   | The initial ability of blind students before being given treatment with a value of FJ 0 and AR 0. At the end of cycle 1, the students' ability was FJ 40 and AR 20. In cycle II, the students' ability increased to FJ 80 and AR 77.5 . From |     | The implementation of literacy movements in inclusive schools helps improve the numeracy literacy skills of students with special needs, although there are several obstacles that need to be overcome. The results of the student learning evaluation test successfully exceeded the Minimum Completion Criteria. The Braille-coded Cartesian Coordinate Board media is suitable for use and can overcome the difficulties of learning mathematics in blind students. |
- The results of the analysis of the 12 articles reviewed revealed several key findings:
- 1. Level of Numeracy Literacy Difficulty in Blind Students**
    - a) Blind students experience difficulties in understanding abstract mathematical concepts (Rohmatul et al., 2024).
    - b) The use of touch-based methods such as finger arithmetic helps with number recognition, but still requires reinforcement of abstract concepts (Panglipur, 2023).
    - c) Some blind students have difficulty connecting numeracy concepts to everyday life due to a lack of visual experiences that support spatial understanding.
  - 2. Learning Strategies Used**
    - a) Jarimatika Method: Helps students recognize number patterns through touch, but requires

additional approaches in abstract concepts (Rohmatul et al., 2024).

- b) Flipped Classroom: Effective in increasing understanding before classroom learning sessions and enabling students to learn more independently (Aminah, 2021).
- c) Braille and Digital Media: The use of media such as Braille-coded PANDIKAR and voice-based applications has been shown to improve students' understanding of numeracy literacy (Rumantining Sih et al., 2020; Puspitasari, 2017).
- d) Contextual Approach: Learning based on daily activities such as buying and selling transactions or measuring objects has been shown to be more effective for blind students because it provides direct experiences that they can feel (Danuri et al., 2022).

### 3. Factors Affecting Numeracy Literacy of Blind Students

- a) Internal factors: level of disability, auditory-kinesthetic learning style, and learning motivation (Panglipur, 2023).
- b) External factors: limited learning media, lack of teacher training, and support from family and school environment (Marlina, 2022).

### 4. Effectiveness of Mentoring Programs and Learning Innovation

- a) The Teaching Campus Program increases the numeracy literacy of blind students through personal guidance (Marlina, 2022).
- b) Technology-based innovations, such as voice-based learning applications, have the potential to support more inclusive learning (Puspitasari, 2017).
- c) The use of AI-based technology in inclusive education is growing and showing positive results in supporting blind students to understand numeracy concepts (Sharma et al., 2022).

One of the most striking findings from all the articles is that the most effective approach is not one based on a single method, but a combination of tactile media, technology, contextual approaches, and individual mentoring. It is proven that adaptive and integrated approaches are more encouraging for

the development of numeracy literacy in blind students than conventional methods.

### D. CONCLUSION AND SUGGESTIONS

Based on the results of the analysis of 12 articles through the *Systematic Literature Review approach*, it can be concluded that the numeracy literacy skills of blind students are still below national education standards. The main difficulties they face lie in understanding abstract mathematical concepts, limited access to adaptive learning media, and lack of pedagogical support that suits their needs. Learning strategies that have been proven effective include the use of tactile methods such as jarimatika and braille media, technology-based approaches such as flipped classrooms and digital applications, and contextual learning that involves direct experience. Internal factors such as learning styles and motivation, as well as external factors such as teacher training and environmental support, greatly influence the achievement of numeracy literacy of blind students.

Therefore, it is recommended that teachers and educators receive intensive training on inclusive and technology-based numeracy learning strategies. The government and educational institutions need to increase adaptive learning media such as braille media, voice learning applications, and other visual-tactile aids. In addition, the involvement of families and school communities must also be increased to support continuous numeracy learning. With these collaborative efforts, it is hoped that the numeracy literacy skills of blind students can improve and help them become more independent in facing academic and daily life challenges.

By implementing this suggestion, it is hoped that the numeracy literacy of blind students can increase significantly and help them face academic and daily life challenges more independently.

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