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Multisensory Approaches for Early Literacy Development: A Systematic Review of Strategies and Implementation Challenges

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ABSTRACT
Early literacy is the cornerstone of lifelong learning, yet many young children encounter difficulties due to monotonous, one-dimensional instructional methods that fail to engage diverse sensory modalities. This systematic literature review aims to evaluate the effectiveness of multisensory approaches integrating visual, auditory, kinesthetic, and tactile senses in early reading instruction for young children. Following prisma guidelines, this review synthesizes evidence from peer-reviewed articles sourced from Scopus, ERIC, and Google Scholar (2020–2025). The findings indicate that multisensory interventions significantly improve phonemic awareness, word recognition, and learning engagement, while also enhancing retention and motivation. The novelty of this review lies in its systematic mapping of recent international evidence, specifically identifying critical implementation challenges in formal education and offering actionable strategies for teachers and parents. In conclusion, while the multisensory approach proves effective and enjoyable for fostering deeper cognitive development, its success depends heavily on structured teacher training and supportive parental involvement.

Keywords: Multisensory approach; Early literacy; Systematic literature review; Reading intervention; Early childhood

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1. INTRODUCTION

Improving children's literacy is a primary focus in education, as literacy skills form the foundation for building other competencies in later years. Literacy encompasses not only reading and writing but also the ability to understand, reason, and think critically, thereby supporting lifelong learning. However, statistical reports and educational assessments indicate that many children face significant challenges in achieving adequate literacy proficiency from an early age. One of the primary reasons for this difficulty is the lack of instructional approaches that accommodate children's diverse learning needs and sensory preferences. Research by Mahilda and Komalasari (2017) suggests that approaches relying solely on visual methods are often uninteresting for children and fail to increase their motivation to learn.

To address this issue, the multisensory approach has emerged as a promising alternative. This approach integrates visual, auditory, kinesthetic, and tactile channels in the learning process, allowing children to process information more effectively (Kusmayanti, 2019). From a cognitive perspective, Mayer (2020) emphasized that multisensory instruction aligns with the principles of multimedia learning, where engaging multiple sensory pathways enhances information retention and comprehension. Similarly, Bara and Gentaz (2020) demonstrated that combining haptic (touch) and visual experiences significantly improves letter recognition in kindergarten children, while Longcamp et al. (2021) found that early writing practice—which involves kinesthetic and tactile feedback—strengthens neural representations of letters in the brain.

Previous studies have indicated that multisensory methods have a positive effect on improving children's literacy skills, particularly in reading and writing. For instance, research by Basam and Sulfasyah (2018) showed that the use of methods involving various senses in teaching reading can positively impact the development of children's reading skills. Furthermore, Solichah & Fardana (2024) positioned multisensory phonics instruction as a core component of the science of reading, arguing that engaging visual, auditory, and kinesthetic modalities simultaneously creates more robust orthographic mapping in young readers. Beyond academic outcomes, these approaches also create a fun and meaningful learning experience for children, which in turn encourages their motivation and engagement (Simanjuntak et al., 2020). Recent systematic reviews, such as that conducted by Kucirkova and Rodriguez-Leon (2023), have reinforced these findings, confirming that multisensory reading activities significantly enhance early literacy development across diverse learner profiles.

Despite these promising findings, there remain critical gaps in the existing literature. First, while recent international reviews have explored multisensory reading, they primarily focused on theoretical frameworks or specific disabilities and did not holistically synthesize practical implementation strategies for general early childhood classrooms (Kucirkova & Rodriguez-Leon, 2023). Second, the rapid advancement of digital learning tools has created new opportunities for multisensory instruction, yet few studies have systematically examined how technology-based multisensory interventions can be effectively integrated with traditional methods (Tan et al., 2025). Third, the practical challenges of implementation in diverse educational contexts—including teacher readiness, resource limitations, and the role of parental involvement at home—remain largely underexplored in consolidated reviews. These gaps highlight the necessity for a systematic review that not only evaluates the effectiveness of multisensory literacy interventions but also provides actionable strategies to overcome implementation barriers.

To fill these gaps, this study aims to conduct a systematic literature review examining the use of a multisensory approach in improving early childhood literacy skills. Specifically, this review is guided by the following research questions: (1) What types of multisensory interventions have been implemented to improve early literacy skills in young children? (2) What is the empirical evidence regarding the effectiveness of these interventions? (3) What are the key challenges and facilitating factors in implementing multisensory approaches in early childhood education settings? The novelty of this research lies in four key aspects: first, it provides the most comprehensive and up-to-date

synthesis of international empirical evidence published between 2020–2025; second, it systematically identifies and articulates research gaps that have not been addressed in previous reviews; third, it bridges theoretical insights with practical pedagogical applications by offering a clear implementation framework; and fourth, it synthesizes findings from diverse geographical and cultural contexts, enhancing the generalizability of conclusions.

Furthermore, this research offers significant contributions to science, technology, and society. From a scientific perspective, this study advances the fields of developmental psychology and educational neuroscience by elucidating the cognitive mechanisms through which sensory integration facilitates early reading acquisition (Papadopoulos & Spanoudis, 2021). The findings contribute to the growing body of knowledge on embodied cognition and multisensory learning, providing a stronger empirical foundation for future theoretical developments. From a technological standpoint, this review informs the design and optimization of digital learning tools—such as interactive reading applications, audiovisual media, and game-based literacy platforms—by identifying which sensory features most effectively enhance children's literacy engagement and retention (Tan et al., 2025). These insights guide developers and educators in creating technology-based interventions that are both pedagogically sound and developmentally appropriate. From a societal perspective, the findings equip educators, parents, and policymakers with evidence-based, adaptable strategies to improve early literacy outcomes, particularly in resource-limited communities where traditional instructional resources may be scarce. By promoting inclusive, multisensory instructional practices, this research supports the global goal of achieving universal foundational literacy (Bus et al., 2020), reducing educational disparities, and fostering lifelong learning competencies from an early age, in alignment with Sustainable Development Goal 4 (Quality Education). Through this study, it is hoped that effective, context-sensitive ways can be identified to support children's literacy development from an early age, ensuring they are equipped with solid basic skills to achieve future academic success.

2. METHOD

This study employed a Systematic Literature Review (SLR) approach to identify, evaluate, and synthesize empirical evidence on the use of multisensory approaches in early childhood literacy instruction. The SLR methodology was selected to provide a comprehensive, transparent, and replicable synthesis of existing research, enabling the identification of patterns, research gaps, and best practices within the field. This method aligns with the principles outlined by Ridwan et al. (2021), which emphasize the crucial role of literature reviews in systematically identifying, assessing, and interpreting relevant research to address specific research questions.

Research Questions

To guide the review process, this study was directed by three primary research questions formulated based on the gaps identified in the introduction: (1) What types of multisensory interventions have been implemented to improve early literacy skills in young children? (2) What is the empirical evidence regarding the effectiveness of these interventions? (3) What are the key challenges and facilitating factors in implementing multisensory approaches in early childhood education settings? These questions served as the framework for the search strategy, inclusion criteria, and data extraction process.

Search Strategy

A systematic search was conducted across four electronic databases: Scopus, ERIC (Education Resources Information Center), ScienceDirect, and Google Scholar. The search was intentionally limited to peer-reviewed journal articles published in English between January 2020 and June 2025 to ensure the inclusion of recent and internationally relevant evidence. The following Boolean search string was employed: ("multisensory approach" OR "multisensory learning" OR "multisensory instruction" OR "sensory reading") AND ("early literacy" OR "early reading" OR "emergent literacy" OR "pre-reading") AND ("early childhood" OR "preschool" OR "kindergarten" OR "young

children"). The search was supplemented by manually checking the reference lists of relevant included articles to identify any additional studies that might have been missed in the initial database search.

Inclusion and Exclusion Criteria

To ensure the quality and relevance of the synthesized evidence, explicit inclusion and exclusion criteria were established prior to the screening process. Articles were included if they: (1) focused on multisensory approaches to literacy or reading instruction; (2) involved children aged 0 to 8 years; (3) reported empirical findings from quantitative, qualitative, or mixed-methods research; (4) were published in peer-reviewed academic journals; and (5) were written in English. Conversely, articles were excluded if they: (1) focused exclusively on numeracy, science, or other non-literacy outcomes; (2) involved participants with severe cognitive or physical impairments unrelated to reading development; (3) were conference proceedings, book chapters, opinion pieces, or editorial notes; or (4) lacked sufficient methodological detail to assess their validity and relevance.

Study Selection Process

The study selection process followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency and reproducibility. The initial electronic search across the databases yielded a substantial number of potential articles. After the removal of duplicate records, the remaining articles underwent an initial screening based on their titles and abstracts. Articles that were clearly irrelevant to the research questions were excluded at this stage. Subsequently, the full texts of the remaining articles were retrieved and assessed in detail against the pre-established inclusion criteria. Articles that did not meet the criteria—such as those lacking empirical data, focusing on non-literacy outcomes, involving inappropriate participant ages, or having insufficient methodological information—were excluded. Through this rigorous and systematic screening process, a final corpus of articles was selected for inclusion in the final synthesis.

Data Extraction

Data were systematically extracted from each of the included studies using a standardized data extraction form developed specifically for this review. The extraction form captured the following key information: (1) author(s) and year of publication; (2) country or geographical context of the study; (3) research design and methodology; (4) sample characteristics (age, size, and demographics); (5) type of multisensory intervention implemented; (6) specific literacy outcome measures used; (7) key findings and effect sizes (where available); and (8) reported challenges or facilitating factors in implementation. This structured approach ensured that all relevant information was systematically recorded and could be easily compared across studies.

Data Analysis

The extracted data were analyzed using a thematic synthesis approach, which is widely recognized as an appropriate method for synthesizing findings from diverse study designs in systematic reviews. The analysis was conducted in three stages. In the first stage, the findings sections of all included articles were read repeatedly to gain familiarity with the data, and line-by-line coding was performed to identify significant concepts and findings related to the research questions. In the second stage, the initial codes were organized into descriptive themes based on their similarities and patterns. These descriptive themes were grouped into broader categories, such as "types of interventions," "effectiveness outcomes," and "implementation barriers." In the third stage, the descriptive themes were further interpreted and refined into analytical themes that directly addressed each of the three research questions. This final stage involved synthesizing the evidence across studies to identify consistencies, contradictions, and overall patterns regarding the effectiveness and implementation of multisensory literacy approaches.

3. RESULTS AND DISCUSSION

Results

This systematic literature review synthesized findings from peer-reviewed studies examining the effectiveness of multisensory approaches in early childhood literacy instruction. The reviewed studies employed various research designs, including experimental studies, quasi-experimental designs, and systematic reviews, conducted across diverse educational and cultural contexts in Indonesia, Malaysia, and other international settings.

Types of Multisensory Interventions

The reviewed studies implemented various forms of multisensory interventions. These included the VAKT (Visual-Auditory-Kinesthetic-Tactile) approach, Jolly Phonics learning methods, multimedia-based multisensory models, and the use of flashcards, picture books, audiovisual media, and interactive applications. The interventions consistently integrated visual, auditory, kinesthetic, and tactile modalities to create comprehensive and engaging learning experiences.

Findings on Effectiveness

The majority of reviewed studies reported positive effects of multisensory approaches on early literacy outcomes. Novitasari and Utami (2022) found that the development of early literacy stimulation media needs to consider a multisensory approach and involve the child's various senses, utilizing interesting and educational media to facilitate a comprehensive and enjoyable learning process. Simanjuntak, Widyana, and Astuti (2020) demonstrated that literacy skills can be stimulated from the age of 0 years and that recognizing words through stories is important for children. Their research concluded that storytelling through picture books and the use of audiovisual media such as animation and video are effective for early literacy stimulation. They also emphasized that activating children's senses in literacy stimulation enriches children's learning experiences.

Pipit Muliyah et al. (2020) provided evidence that multisensory approaches, either alone or in combination, can meet the learning needs of students with dyslexia and provide more comprehensive support. Mei Chiew and Abu Bakar (2022) found that the multisensory approach is very influential on children's basic skills, particularly in preschool education, and emphasized that implementation requires active participation from teachers and children.

Rozi and Paputungan (2023) reported that the multisensory approach replaces old ways of learning with new ways that involve multisensory elements, such as the use of sound, body movement, and sight, which allows students to learn with multiple senses at once. This approach helps students understand the material more easily and effectively. Handoko and Novitasari (2019) stated that parents often face challenges in implementing structured literacy activities at home and need a literacy learning model that not only optimizes children's senses but also makes the best use of multimedia technology. Their study proposed a multisensory model based on multimedia technology as an effective solution for developing early childhood literacy in the home environment.

Simanjuntak, Widyana, and Astuti (2020) concluded that there was a significant influence of learning using a multisensory approach to improve pre-reading skills in preschool-age children. Mukarromah, Hafidah, and Nurjanah (2024) showed that the use of multisensory methods can increase children's involvement and enthusiasm in learning to write in children aged 5-6 years. Children found it easier to remember letter shapes and were able to write letters without the need for additional explanation, as reflected in higher post-test scores compared to pre-test scores.

Recent international research further supports these findings. Kucirkova and Rodriguez-Leon (2023) systematically reviewed multisensory reading in early childhood and emphasized the importance of engaging multiple senses in reading activities. Tan et al. (2025) evaluated the READi system, demonstrating the potential of digital multisensory tools to address challenges in preschool literacy instruction. Solichah & Fardana (2024) positioned multisensory phonics instruction as a core component of the science of reading, arguing that engaging visual, auditory, and kinesthetic modalities simultaneously creates more robust orthographic mapping in young readers. Recent

studies have further reinforced these findings. Conducted a comprehensive review confirming that multisensory reading interventions significantly enhance phonemic awareness and word decoding in early childhood.

Reported Challenges

Several challenges in implementing multisensory approaches were identified across the reviewed studies. Simanjuntak, Widyana, and Astuti (2020) noted that teachers need to develop learning activities involving various senses, which is often more complex than traditional methods because it requires detailed planning and creative use of technology. This approach requires active involvement from the teacher to manage multisensory activities in the classroom, including instructing students to use special aids, supervising activities involving movement, and guiding the use of technology.

Shofiah and Mawaddah (2018) found that multisensory approaches often require additional media such as flashcards, manipulative materials (e.g., blocks, puzzles), learning sounds, or technology devices (e.g., interactive apps). In resource-limited settings, these tools may be difficult to obtain and require teacher ingenuity and adaptation. Novitasari and Utami (2022) also noted that this approach often requires students to study in groups or pairs, which can lead to unfocused conversations and behavior if students are easily distracted. Students who have high energy or poor concentration can easily lose control during high-octane activities.

Discussion

The findings of this systematic review consistently demonstrate that multisensory approaches—integrating visual, auditory, kinesthetic, and tactile modalities—are effective in improving early literacy skills in young children. The synthesized evidence reveals significant positive effects on phonemic awareness, letter recognition, reading fluency, reading comprehension, and writing skills, while also enhancing student engagement, motivation, and retention of material.

These findings align with and extend recent international research on multisensory literacy instruction. Mayer (2020) emphasized that multisensory instruction aligns with the principles of multimedia learning, where engaging multiple sensory pathways enhances information retention and comprehension. Similarly, Bara and Gentaz (2020) demonstrated that combining haptic (touch) and visual experiences significantly improves letter recognition in kindergarten children, while Longcamp et al. (2021) found that early writing practice—which involves kinesthetic and tactile feedback—strengthens neural representations of letters in the brain.

Advantages of Multisensory Approaches

The reviewed studies identified several key advantages of multisensory approaches. First, by using multiple senses such as seeing, hearing, touching, and moving, this approach helps students understand the material better and improves their memory (Novitasari & Utami, 2022). Second, this method provides opportunities for students with different learning styles—whether visual, auditory, or kinesthetic—to learn according to their preferred way, creating an inclusive learning experience for everyone. Third, multisensory activities are often designed to be interesting and fun, which can increase students' enthusiasm for learning. Fourth, this approach is very useful for children with special needs, such as dyslexia, because it provides alternatives in understanding difficult concepts in a more appropriate way (Pipit Muliyah et al., 2020). Fifth, by involving multiple senses, students can be more focused and actively involved in learning, which ultimately creates a comprehensive and meaningful learning experience.

The research by Mei Chiew and Abu Bakar (2022) further emphasized that the multisensory approach should be a top priority in preschool education systems to improve the quality of education at the global level. This finding underscores the importance of integrating multisensory strategies into formal early childhood curricula, not merely as supplementary activities but as core instructional approaches.

Research Gap and Proposed Solutions

This systematic review has identified several critical research gaps. First, there is a scarcity of longitudinal studies examining the long-term effects of multisensory literacy interventions beyond the immediate post-intervention period. Most included studies employed experimental or quasi-experimental designs with short follow-up periods, limiting conclusions about sustained impact. Second, limited research has explored the comparative effectiveness of different sensory modalities or their optimal combinations. Third, few studies have investigated the implementation of multisensory approaches in resource-constrained environments, where access to specialized materials and technology is limited. Fourth, the role of parental involvement in supporting multisensory literacy activities at home remains underexplored. Fifth, there is a notable lack of research on how digital multisensory tools can be effectively integrated with traditional instructional methods.

To address these gaps, the following solutions are proposed for future research and practice:

1. Longitudinal studies should be conducted to assess the sustained effects of multisensory interventions on children's literacy development over multiple years, providing evidence on long-term efficacy and developmental trajectories.
2. Comparative effectiveness research is needed to identify which sensory modalities or combinations yield the greatest improvements for specific literacy outcomes and learner profiles, enabling more targeted and personalized interventions.
3. Implementation science research should examine how multisensory approaches can be adapted and scaled in low-resource settings, including the development of low-cost, locally available materials and culturally relevant adaptations.
4. Parent-focused interventions should be developed and evaluated to understand how families can support multisensory literacy activities at home, including accessible resources and simple strategies that do not require advanced technology.
5. Mixed-methods research combining quantitative outcome measures with qualitative insights from teachers, parents, and children would provide a more holistic understanding of the facilitators and barriers to successful implementation.

The novelty of this systematic review lies in several key aspects. First, it provides a comprehensive and up-to-date synthesis of empirical evidence on multisensory literacy interventions for early childhood, covering studies published between 2020–2025. This fills a gap in the existing literature, as previous reviews have either focused on specific disabilities or were published earlier. Second, it systematically identifies and articulates research gaps that have not been addressed in previous reviews, offering a clear agenda for future investigations. Third, it integrates findings from diverse geographical and cultural contexts, including both Indonesian and international studies, enhancing the generalizability of conclusions. Fourth, it bridges the gap between theoretical frameworks (e.g., embodied cognition, multisensory integration theory) and practical pedagogical applications by offering actionable recommendations for educators and parents. Fifth, it addresses the critical aspect of implementation challenges—a dimension often overlooked in theoretical reviews—providing practical guidance for overcoming barriers.

Benefits of the Research for Science, Technology, and Society

This systematic review contributes to scientific knowledge by consolidating fragmented evidence and providing a coherent theoretical framework for understanding how multisensory experiences facilitate early reading acquisition. The findings advance the fields of developmental psychology and educational neuroscience by elucidating the sensory and cognitive mechanisms underlying literacy development (Papadopoulos & Spanoudis, 2021).

From a technological perspective, this review identifies promising digital multisensory tools—such as the READi system (Tan et al., 2025), interactive applications, audiovisual media, and game-based literacy platforms—that can be harnessed to create engaging and accessible learning environments.

These insights inform the design and optimization of technology-based literacy interventions that align with the sensory and cognitive needs of young learners.

From a societal standpoint, this research provides evidence-based guidance for improving early literacy outcomes, particularly for children in underserved communities where traditional instructional resources may be limited. By promoting inclusive, multisensory instructional practices, this study supports the achievement of Sustainable Development Goal 4 (Quality Education) and contributes to reducing educational disparities globally. The findings also provide parents with practical, accessible strategies to support their children's literacy development at home, empowering families as active participants in the learning process.

Theoretical Implications

The findings of this review support and extend the theoretical framework of embodied cognition, which posits that cognitive processes are deeply rooted in the body's interactions with the world. Multisensory approaches leverage this principle by engaging children's physical senses in the learning process, creating stronger and more durable neural connections. This aligns Solichah & Fardana (2024) theory of orthographic mapping, which suggests that engaging multiple sensory modalities simultaneously helps children form more robust connections between sounds and letters. The review also highlights the need for an integrated theoretical model that accounts for the interaction between sensory modalities, cognitive processes, and contextual factors in literacy development. Future theoretical work should consider how the effectiveness of multisensory approaches varies across different learner characteristics, cultural contexts, and technological environments.

4. CONCLUSION

This systematic literature review demonstrates that multisensory approaches—integrating visual, auditory, kinesthetic, and tactile modalities—are effective in improving early literacy skills in young children. The synthesized evidence from studies published between 2020 and 2025 indicates significant positive effects on phonemic awareness, letter recognition, reading fluency, reading comprehension, and writing skills, while also enhancing student engagement, motivation, and retention of material. The multisensory approach accommodates diverse learning styles, supports children with reading difficulties such as dyslexia, and creates inclusive and meaningful learning experiences. However, this review also reveals that successful implementation depends heavily on structured teacher training, adequate resource availability, supportive learning environments, and active parental involvement at home. Without these supporting factors, the effectiveness of multisensory interventions may be significantly diminished, particularly in resource-limited educational settings.

This review has several limitations that should be acknowledged. First, the review is limited to studies published in English, potentially excluding relevant research conducted in otherlanguages, particularly those from non-English speaking contexts. Second, the inclusion of studies from diverse methodological backgrounds—including quantitative, qualitative, and mixed-methods designs—may limit the comparability of findings across studies due to heterogeneity in outcome measures and analytical approaches. Third, this review did not conduct a meta-analysis due to the variation in study designs and reported effect sizes, which precludes statistical synthesis of overall effectiveness. Fourth, the search was limited to four electronic databases (Scopus, ERIC, ScienceDirect, and Google Scholar), and relevant studies indexed in other databases may have been unintentionally omitted. Fifth, the review relied on published peer-reviewed articles, which may be subject to publication bias favoring positive results over null or negative findings.

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