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Exploring multisensory programs as early literacy interventions: a scoping review

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ABSTRACT

It is essential for children in their early childhood to possess early literacy. Over the past decade, there has been relatively limited exploration of multisensory approaches to enhance literacy skills in early childhood. Consequently, this study aims to conduct a scoping review to identify and synthesize research supporting multisensory programs as an early literacy intervention for children. We conducted searches in seven databases that were published from 2012 to 2022, resulting in the inclusion of sixteen articles meeting the specified criteria. Our findings reveal several forms of multisensory programs that parents can carry out to improve early literacy skills: i) visual (e.g., drawing, interpreting the meaning of the words/sentences they read, playing with alphabet cards, reading words or sentences correctly, and reading labels on food and toy packaging); ii) auditory (e.g., singing, reading story books, mentioning letter sound symbols, spelling syllables, language activities, speeches, and storytelling); iii) kinesthetic (e.g., dividing words according to syllables in children using media strips, writing, clapping, marching, dancing, and drama); and iv) tactile (e.g., write the word with the index finger on the flannel/cloth). Most of the included studies employed experimental or quasi-experimental study designs. Thus, future studies are advised to incorporate randomized controlled trials.

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1. INTRODUCTION

Early literacy is the process of acquiring knowledge, skills, and attitudes related to reading and writing before children attain the ability to read and write themselves. This developmental process occurs continuously from infancy, long before formal literacy instruction takes place in school or at the elementary education level [1]. Early literacy skills encompass the capacity to name and write letters, spell simple words, recognize letters and signs in their environment, identify books and titles, and engage in book-related activities [2], [3]. Children's expression, from babbling as infants to their interactions with books and their interest in pictures, is viewed as a facet of early literacy learning. The emergence of literacy in children corresponds to their growing awareness and readiness for reading and writing activities before they achieve full proficiency in these skills. This process relies on children's and parents' preparedness to consistently introduce and engage in literacy-related activities [4], [5].

Past studies thus far indicate that early literacy skills can predict children's reading development from a young age [6], [7]. Emphasizing early literacy programs is paramount, as they significantly contribute

to children's future success. Literacy learning enables children to acquire fundamental life skills, including accessing, processing, and sharing information [8], [9]. Proficiency in oral and written communication, such as reading and writing, is a fundamental skill that all individuals must possess [10], [11]. Given these considerations, it is imperative to provide appropriate stimulation to foster the development of early literacy skills in children.

Multisensory programs have effectively enhanced early literacy skills [12]–[17]. A multisensory program employs a learning approach that engages visual, auditory, kinesthetic, and tactile abilities. Multisensory education entails the activation of all five senses to gather impressions through tactile, visual, kinesthetic, and auditory stimuli [18], [19]. Multisensory programs cater to diverse learning styles among children, such as those with visual, auditory, and kinesthetic preferences [20], [21]. These approaches are promising for young children since they incorporate techniques to stimulate and integrate various processing modalities, including visual, auditory/phonological, tactile, and kinesthetic [22], [23].

Research on multisensory programs to enhance early literacy skills has only gained prominence in the past decade. Within the 2012-2022 timeframe, we identified two literature review studies [12], [24] that demonstrated the effectiveness of multisensory methods in improving early childhood reading and writing skills. The literature review reveals a scarcity of research addressing multisensory stimulation for early literacy. None of the limited existing studies have been investigated through meta-analyses, systematic literature reviews, or scoping reviews. This study uses a scoping review to identify and synthesize research supporting early literacy development through multisensory programs. This scoping review aims to answer the following questions: i) what forms of multisensory programs can improve early literacy? and ii) what research designs have been employed in these studies?

2. RESEARCH METHOD

The scoping review analysis in this article adhered to the guidelines outlined in the PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation [25] to ensure the quality of reporting. The scoping review methodology comprised six framework stages: i) identifying the research question; ii) identifying relevant studies; iii) selecting studies; iv) charting the data; v) collecting, summarizing, and reporting the results; and vi) conducting a consultation exercise [26].

We formulated the following research questions to guide our exploration of the search results: i) what forms of multisensory programs can improve early literacy?; and ii) what research designs have been employed in these studies? These questions serve as a framework for analyzing and understanding the various approaches and methodologies utilized in research related to the scoping review. By addressing these queries, we aim to gain insights into the diverse strategies and designs employed in studies focused on the intersection of multisensory program and early literacy development.

We conducted a database search across seven international databases and one national database, specifically SAGE (journals.sagepub.com), Scopus (scopus.com), ResearchGate (researchgate.net), Semantic Scholar (semanticscholar.org), Google Scholar (scholar.google.com), Web of Science (webofscience.com), ScienceDirect (sciencedirect.com), and the Garuda Portal (garuda.kemdikbud.go.id). The search terms we used included the keywords ‘multisensory program’ AND ‘early literacy.’ Additionally, we conducted a backward reference search through our included papers to identify more relevant articles.

We conducted the first search in June 2022 and continued until November 2022. In total, 1,796 articles were retrieved from all the databases. After thoroughly analyzing various articles, we identified and included 16 articles that met the specified criteria in this review. Details are presented in Figure 1. The search yielded scientific articles from various sources, including two from SAGE, four from Scopus, three from Research Gate, two from Semantic Scholar, one from Google Scholar, one from Web of Science, one from Science Direct, and two from Garuda Portal. We included studies that meet the following inclusion criteria:

i) Population: child early age (0-7 years), preschool children (3-7 years), 1st grade children (6-7 years), teachers, and parents
ii) Concept: multisensory program to improve early literacy
iii) Context: family environment, home, and school
iv) Article type: original research articles and literature reviews

We excluded papers that meet the following exclusion criteria: i) studies that do not report the utilization of multisensory programs for enhancing early literacy skills; ii) opinion pieces, letters, and other non-original research work; iii) unpublished gray literature, including theses and working papers; iv) research exclusively centered on the use of multisensory programs for animal treatment; and v) studies exclusively focus on applying multisensory programs to treat children with dyslexia, reading difficulties, hearing impairments (e.g., deafness), intellectual disabilities, and special needs.

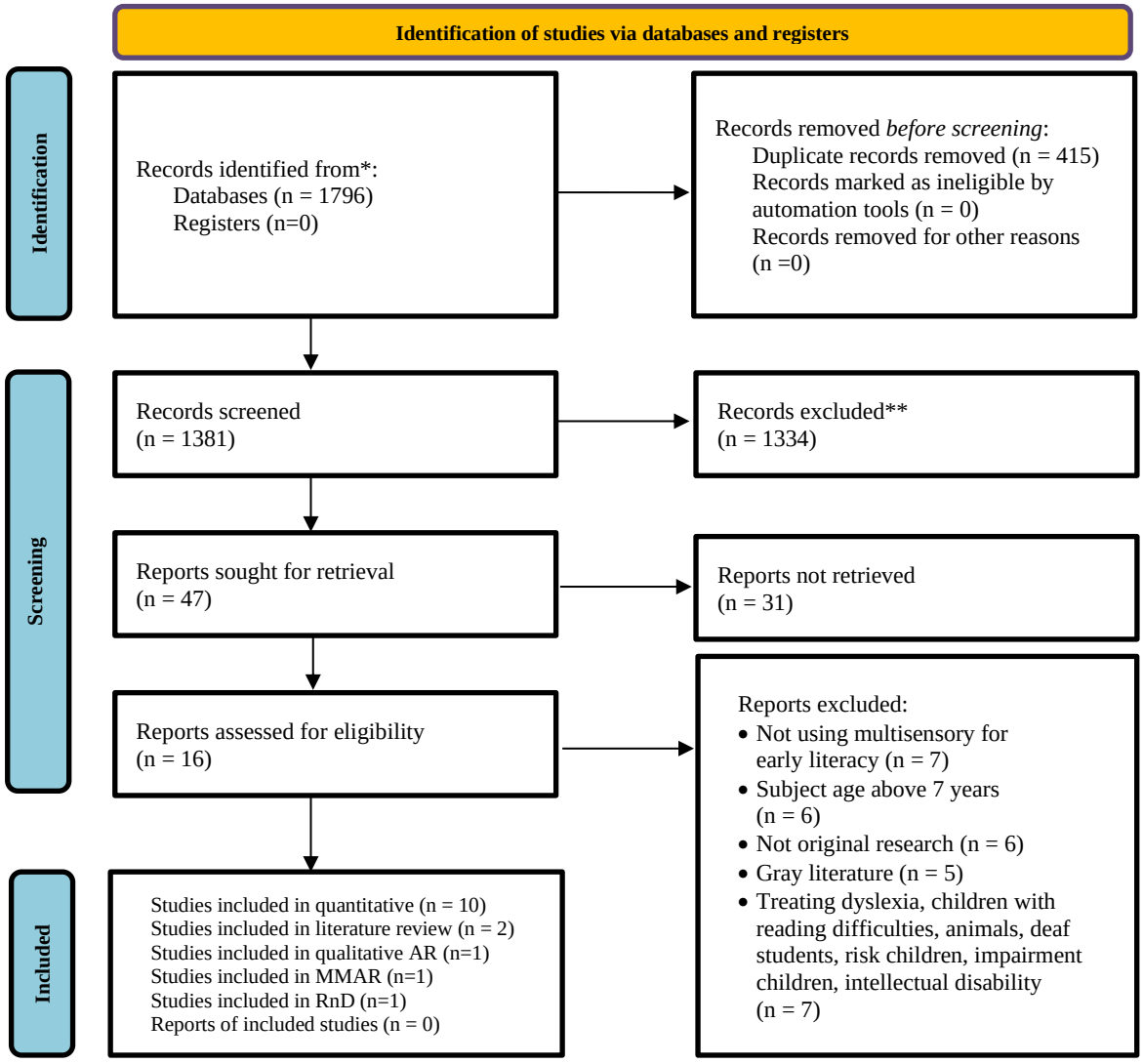

Figure 1. PRISMA 2020 flow diagram for new systematic review, which included searches of databases

3. RESULTS AND DISCUSSION

3.1. What forms of multisensory programs can improve early literacy?

Multisensory program have demonstrated their effectiveness in enhancing early literacy in early childhood [27]. These programs engage children in a holistic learning experience that accommodates different learning styles by incorporating visual, auditory, kinesthetic, and tactile stimuli. Teachers and parents can implement these programs, which encompass various sensory modalities.

3.1.1. Visual

Activities such as drawing, which includes coloring and creating lines [28], [29], interpreting the meaning of words/sentences, including reading and understanding the functions of punctuation marks [30], [31], playing with alphabet cards to combine visual and phonological learning [14], [32], engaging in writing exercises to keep children focused on the task and engaged in the learning process [33], [34], and reading labels on food and toy packaging, incorporating a multisensory approach with environmental print [12].

3.1.2. Auditory

Activities like reading storybooks, which foster interactions between mother and child, encouraging them to focus on the book's content and actively participate in discussions [14]. Language and speech activities initiated early with children aged 3 to 5 raise awareness of language's sound and rhythm, influencing phonological awareness (PA) [35], [36]. Storytelling also elicits enthusiastic responses from children [29], [37].

3.1.3. Kinesthetic

Engaging children in word segmentation using media strips and laminated cardboard to form syllables (for example, 'paktu' composed of [p], [a], [k], [t], [u], resulting in syllables [ak] or [tu]) [38] and providing activity books, as children with more interaction through these books tend to exhibit greater reading motivation [14], [39]. Pairing pictures with writing serves as an indicator of early writing ability in children [38], [40]. Activities like clapping, lining up, dancing, and engaging in creative drama are also employed [36], [41].

3.1.4. Tactile

Tactile activities involve using the sense of touch. One such activities is writing words with the index finger [19]. Writing words with the index finger on flannel or cloth surfaces [2], [19], [20].

3.2. What research designs have been employed in these studies?

Research using multisensory programs to enhance early literacy skills has gained prominence in the past decade. The results of the 16 included studies underscored the effectiveness of multisensory approaches in stimulating early literacy stimulation. These studies consisted of 11 quantitative studies [10], [13], [17], [20], [27], [32], [41]–[44], one qualitative study [14], [45], two mixed-method study [29], [46], [47], and two literature reviews [12], [24].

Furthermore, the included studies employed various methodologies, including experimental design [10], [13], [17], [20], [32], [43]–[45], quasi-experimental design [27], [48]; action research [14], quasi-experimental action research [42], literature reviews [12], [24], classroom action research (CAR) [40], and mixed method [29]. Most of the included studies employed experimental or quasi-experimental designs. No studies have used a randomized control trial (RCT).

There is still limited research on multisensory programs in Indonesia, with only two articles from Indonesia [45]. In contrast, there are 14 English-language articles: [10], [13], [14], [17], [20], [24], [27], [29], [32], [35], [36], [42]–[45]. In terms of population groups, one study was conducted with parents [10], two with mothers [14], [29], one study with mothers and their kids [49], nine studies with kindergarten students [17], [20], [27], [32], [42]–[44], [50], and one with kindergarten teachers [13].

Study by Neumann [10] involved 32 parent-child pairs that implemented the following multisensory approaches: identifying, tracing, and writing letters and words with environmental print. Ruhaena and Moordiningsih [29] conducted research with 56 mothers with children aged 2-5 years, focusing on multisensory activities such as reading books, storytelling, playing with letter cards, and drawing. With the same sample group, Ruhaena [14] interviewed mothers involved in multisensory activities, which included reading storybooks and using alphabet cards. Additionally, Ruhaena and Moordiningsih [29] conducted research involving 75 mothers with children aged 3-5 years in Surakarta, implementing multisensory activities such as observing objects and pictures, storytelling, and playing with plasticine.

Phillips and Feng [50] conducted a study with 471 students ranging from kindergarten, comparing traditional flashcard methods with multisensory approaches for word matching in kindergarten. In addition, Widyana *et al*. [32] conducted research with two experimental groups and one control group, focusing on multisensory activities like identifying letters, collecting letters with pictures, and recognizing two easy syllables. Oktafianto *et al*. [44] conducted a study involving 40 Kindergarten ABA 1 Bangkalan students aged 5-6 years, where multisensory activities included mentioning known letters and syllables. Research by Tarjiah *et al.* [51] implemented multisensory activities that involved providing letter cards, embossed letters, choosing words in reading, verbally guessing letters held up by the teacher with letter cards, students observing the shapes through embossed media, and parental support. Lozy *et al*. [20] conducted research involving six preschool students in Lousiana, United States, using multisensory methods such as speaking words, writing words with their index finger on the rug, saying words aloud, and tracing and underlining words with a pencil on worksheets with word lists. Labat *et al*. [43] involved 50 monolingual French children (F=25; M=25) with an average age of 5 years and four months, applying multisensory approaches to spelling, writing, and reading in primary grades. Labat *et al*. [43] involved 48 French monolingual children, with an average age of 67 months, 24 girls and 24 boys, exploring letter shapes as their multisensory methods. Zulhendri and Warmansyah [27] conducted research with grade 1 children at SDN 10 Ganting Bigau (N=34) and SDN 19 Koto Tuo Difficult Air (N=33), applying multisensory methods by testing alphabet knowledge, word concepts, letter spelling, and interpretation of difficult words.

Ghoneim and Elghotmy [52] involved 40 kindergarten teachers in the second semester of the 2014-2015 academic year, providing multisensory learning in the form of teaching letter sounds, letter formation, combining sounds and letters for reading, identifying sounds for writing, and spelling difficult words. Through an extensive literature review, Novita and Juhairiah [24] demonstrated that multisensory approaches can improve reading and writing skills in early childhood. Similarly, Neumann *et al*. [53] also highlighted

several multisensory techniques that could be used to improve early literacy, such as pointing to letters on title pages (visual), stating their names and sounds (auditory), writing letters in the sky (kinesthetic), tracing the letters with a finger (tactile), and reading food packaging labels at home.

3.3. Discussion

The multisensory program was initially designed for individuals experiencing reading and writing difficulties associated with dyslexia [54]. However, in the past decade, researchers conducted studies using multisensory programs to improve early literacy skills [12]–[17], [55]. Multisensory approaches have proven highly valuable and impactful by significantly boosting literacy activities and fostering the development of children's literacy skills [29]. Teachers utilized multisensory techniques during reading lessons, particularly focusing on open syllables, positively influencing children's reading skills development. However, to ensure effectiveness, multisensory techniques must be reinforced with appropriate materials [15], [42]. In China, multisensory approaches have effectively improved Chinese early literacy [17]. Consequently, multisensory approaches are not limited to children with dyslexia but are also employed as a teaching method for early childhood education.

Research indicates that literacy activities actively engaging children in exploration and participation are highly stimulating [56], [57]. Preschool literacy development has historically relied on textual teaching methods with limited active participation, primarily engaging visual and auditory senses. Active learning methods that stimulate all sensory organs, or multisensory approaches, prove more effective for preschool children, aligning with their developmental needs and psychological characteristics [58]. Multisensory approaches enhance children's abilities because stimuli received through visual, auditory, and kinesthetic senses are retained more deeply and for longer periods [49], [59]. Multisensory approaches select sensory modalities carefully to provide optimal learning experiences, ensuring the achievement of children's educational objectives [15]. Thus, comprehensive sensory stimulation that encompasses all sensory modalities increases children's engagement in the learning process, fosters their learning capacity and potential, stimulates effective brain processes, nurtures positive attitudes, and improves fundamental literacy skills. Previous research demonstrates that multisensory programs effectively enhance literacy skills in young children [27], [60].

The analysis reveals that multisensory programs significantly impact children's early literacy skills because they engage various senses, including visual (sight), auditory (hearing), kinesthetic (movement), and tactile (touch), often abbreviated as VAKT [21]. Previous research has consistently shown that multisensory programs are effective in enhancing early childhood literacy [12]–[17], [55]. Multisensory programs encompass various activities to enhance early childhood literacy skills. These include visual (e.g., drawing, interpreting the meaning of words/sentences they read, playing with alphabet cards, reading words or sentences correctly, and reading labels on food and toy packaging), auditory (e.g., singing, reading storybooks, mentioning letter sound symbols, spelling syllables, language activities, speeches, and storytelling), kinesthetic (e.g., dividing words into syllables using media strips and laminated cardboard, providing activity books, pairing pictures with writing, emphasizing neatness in writing, clapping, marching, dancing, and engaging in creative drama), and tactile (e.g., writing words with the index finger on flannel/cloth).

Research on multisensory programs aimed at enhancing early literacy skills developed only in the past decade. The included 16 studies demonstrated the effectiveness of multisensory methods for early literacy stimulation. The literature review revealed a limited number of studies that explored the use of multisensory programs to stimulate early literacy, and these studies did not utilize meta-analysis, systematic literature reviews, or scoping reviews. Among the ten experimental studies, eight focused on early childhood subjects, one involved parent-child interactions, and one targeted teacher. All the included experimental studies have not used the CONSORT checklist. Thus, future studies are encouraged to consider using a RCT that conforms to the CONSORT checklist. In qualitative research, research and development and action research were carried out on teachers. We found one mixed-method study that was conducted on parents-additionally, some research employed mixed methods or action research with parents and teachers as subjects.

Understanding multisensory programs for early literacy is crucial for children, teachers, and parents [13], [15], [61]. Teachers and parents [10], [62] still require comprehensive knowledge to support their children's education and ensure that the programs they implement are current, practical, and evidence-based [63]. Limited research has been conducted on literacy development programs within the home context [10], [29], [64]. Future research may explore multisensory programs in conjunction with technology [18], [60].

4. CONCLUSION

This paper has provided a comprehensive overview of multisensory programs tailored to children's abilities. Although research on multisensory programs to improve early childhood literacy is scarce, this paper has comprehensively described current multisensory programs suitable for children's abilities. However, this scoping review article has limitations. Specifically, the review's robustness is somewhat lacking, references and literature reviews are limited due to the emergence of new topics over the past decade, and there is a deficiency in professional scrutiny regarding substance improvement. Future studies should expand multisensory research programs for early literacy targeted at parents. Few studies have focused on parents, and further research with stricter control measures is needed. Early literacy is a critical skill that must be developed in childhood, and parental involvement is pivotal in enhancing children's early literacy skills.

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