

## The Effectiveness of Sensory Play Interventions on the Fine Motor Development of Early Childhood Children

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**ABSTRACT:** Fine motor development is a crucial aspect of early childhood growth, as it supports children's readiness for academic activities, independence, and adaptive functioning. In recent years, sensory play has been increasingly implemented as an intervention to stimulate fine motor abilities in early childhood education settings. This study aims to examine the effectiveness of sensory play interventions on the fine motor development of young children through a literature-based analytical approach. The study employs a systematic literature review method by analyzing empirical studies published in national and international journals within the last ten years. Articles were selected using inclusion criteria focusing on early childhood participants, sensory play interventions, and measurable fine motor outcomes. The findings indicate that sensory play interventions significantly contribute to the improvement of fine motor skills, including hand-eye coordination, finger strength, grasping ability, and manipulation skills. Various sensory play activities such as kinetic sand play, finger painting, water play, clay modeling, and tactile exploration were found to enhance children's engagement and sensorimotor integration. In addition, sensory play creates enjoyable and meaningful learning experiences that encourage active participation and developmental stimulation. The review also highlights that intervention effectiveness is influenced by the frequency of activities, environmental support, and educator involvement. Therefore, sensory play can be considered an effective and developmentally appropriate strategy for optimizing fine motor development in early childhood education. The study recommends integrating sensory play into daily learning activities and encourages further experimental research with broader samples and longitudinal designs to strengthen empirical evidence.

**KEYWORDS:** sensory play, fine motor development, early childhood, intervention, child development.

### I. INTRODUCTION

Early childhood, which includes the ages between 0-6 years, is the most important and crucial period in human life, and is referred to as the golden age. All aspects of a child's development, including physical-motor, cognitive, language, socio-emotional, and artistic development, progress very rapidly during this stage. The development that occurs at this stage will greatly influence the quality of the child's life in the subsequent stages. Therefore, it is very important for parents, educators, and the surrounding environment to provide appropriate, engaging, and developmentally appropriate stimulation for the child.

Fine motor development is one aspect of development that must receive serious attention. Fine motor skills are the child's ability to perform movements using small muscles, especially in the fingers and wrists, which require precise hand-eye coordination. Fine motor skills are very important for a child's readiness to engage in various daily activities such as writing, drawing, cutting, pasting, etc.

Sensory play, also known as sensory play, involves all of a child's senses, such as smell, hearing, sight, and touch, and uses various play media with different textures, colors, shapes, and stimuli. Some studies have shown that this is one of the effective ways to enhance the fine motor skills development of young children. Sensory play helps children learn directly. This makes fine motor development enjoyable, active, and meaningful. In Indonesia, more and more research is investigating the impact of creative play and sensory-based interventions on fine motor development as early childhood education practices evolve. In addition to conventional sensory play, various activities such as collage, bead threading, parts separation, sensory play in kindergartens, and digital finger painting have been researched and proven beneficial. To thoroughly summarize and synthesize these findings, a comprehensive and systematic review is necessary.

Based on this background, this research aims to conduct a systematic literature review on several studies that discuss the effectiveness of sensory play and sensory-based activities in supporting the fine motor development of early childhood children. Therefore, the results of this study are expected to help in developing evidence-based early childhood education practices. These practices are intended to optimally maximize the development of children's fine motor skills.

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## II. RESEARCH METHOD

This research uses the Systematic Literature Review (SLR) method, which aims to systematically identify, evaluate, and synthesize findings from various relevant primary studies. The SLR method was chosen because it can provide a comprehensive and objective overview of a research topic based on empirical evidence from various scientific sources.

### A. Inclusion and Exclusion Criteria

All articles in this review meet the following criteria: (1) research published in 2021–2025; (2) research discussing sensory-based interventions or play activities in early childhood (0–6 years); (3) research focusing on fine motor development as the dependent variable; (4) research using quantitative methods (experiments, quasi-experiments, action research, R&D), as well as descriptive qualitative or mixed methods. This article is not relevant to the topic or does not contain data on the motor development of early childhood.

### B. Data Source

Literature search was conducted thru various electronic databases, such as Google Scholar, SINTA, Jurnal Obsesi, Murhum, PAUD Agapedia, and trusted university repositories in Indonesia. "Sensorial play," "fine motor skills," "early childhood," "early childhood education," "hand drawings," "playdough," "fine play," "collage," "beading," "detachable parts," and "fine motor skills" are some of the keywords used. As a result of the systematic selection process, 22 articles were found that met the inclusion criteria.

### C. Data Analysis

The data collected from twenty-two research articles were analyzed descriptively-narratively and thematically. This included categorizing the data by theme, coding important information from each article, and synthesizing the results to identify patterns and draw comprehensive conclusions. Types of interventions, research methodologies, subjects, developed fine motor skills, and the effectiveness of interventions are the dimensions analyzed.

## III. RESULTS

Types of sensory-based interventions that have proven effective in improving fine motor skills in early childhood were identified in the review of 22 research articles. Interventions fall into four major categories. All the reviewed studies show that creative play and sensory interventions are proven effective in improving the fine motor skills of early childhood children. Ten additional journals identified reinforce and expand the findings of the 12 main journals. Based on theoretical studies from various research, at least four main mechanisms explain how sensory play enhances children's fine motor skills. Analysis of 22 studies identified several important factors that influence the effectiveness of interventions. The results of this systematic review have many significant implications for how early childhood education is conducted.

### A. Types of Successful Sensory Play Interventions

Tactile sensory media-based games fall into the first category. These sensory media-based games include sensory-based games in educational settings (Iswahyuni et al., 2023), messy play (Nuryanah & Ramdhani, 2022), magic sand (Hidayah & Rocmah, 2024), and DIY sensory games (Al Fathia et al., 2024; Lestari & Kuswanto, 2025). Thru various textures, shapes, and material characteristics, this media directly stimulates children's tactile senses. This trains finger muscle strength and hand-eye coordination. Tactile sensory media-based games fall into the first category. These sensory media-based games include sensory-based games in educational settings (Iswahyuni et al., 2023), messy play (Nuryanah & Ramdhani, 2022), magic sand (Hidayah & Rocmah, 2024), and DIY sensory games (Al Fathia et al., 2024; Lestari & Kuswanto, 2025). Thru various textures, shapes, and material characteristics, this media directly stimulates children's tactile senses. This trains finger muscle strength and hand-eye coordination. Art and creativity-based interventions fall into the second category. This includes digital hand painting using an LCD drawing board (Utami et al., 2024), digital hand painting (Faradillah et al., 2022; Ditha et al., 2025). Activities that use fingers to apply paint whether on conventional or digital media cutting, pasting, and coloring require precise hand movement coordination, which trains children's fine motor skills.

Handicraft-based interventions fall into the third category. This includes weaving with natural materials (Nisa & Aulina, 2024), beading activities (Oktafiani & Rakimahwati, 2023; Nuraya et al., 2022), and collage (Insana et al., 2022; Qomariah et al., 2024; Anwar et al., 2025). These activities require strength, coordination, and precision of finger muscles to insert, arrange, and attach various media systematically.

Interventions based on loose parts media and sensory tracks constitute the fourth category. Examples include loose parts media (Febriyanti et al., 2023; Wathoni et al., 2024) and Playmate Sensory based on sensory tracks (Rahmawati et al., 2025). The use of unstructured materials (loose parts) such as grains, bottle caps, buttons, and dried leaves offers an extraordinary multisensory exploration experience while naturally enhancing fine motor skills.

### B. The Effectiveness of Interventions on Fine Motor Skills

All the reviewed studies show that creative play and sensory interventions are proven effective in improving the fine motor skills of young children. With a quantitative design, the research produced strong statistical evidence. Ilmiyah et al. (2024) found a

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significance value of  $p = 0.001$ . Pamungkas et al. (2023) found that the playdough intervention increased the average fine motor skills score from 29.93 to 39.53. Febriyanti et al. (2023) showed that loose parts media had a significant impact on the fine motor skills of children in Palembang.

Classroom Action Research (CAR) has also increased. Using Magic Sand media, Hidayah & Rocmah (2024) reported an increase in fine motor skills from 49.3% before the cycle to 95.1% after the second cycle. Nuryanah & Ramdhani (2022) reported an increase in messy play from 45-56% in the first cycle to 79-86% in the second cycle. Each cycle of this PTK shows consistent improvement. This shows that the frequency and intensity of stimulation are positively correlated with the improvement in fine motor skills.

(1) hand-eye coordination; (2) finger and wrist muscle strength; (3) gripping and pinching ability; (4) flexibility and precision of finger movements; (5) manipulative skills such as inserting objects, stringing beads, and cutting; and (6) precision in arranging and sticking small objects are some aspects of fine motor skills that have consistently improved in various studies.

### ***C. Findings from the Journal***

Iswahyuni et al. (2023) found that the four types of sensory play used in daycare significantly improve the fine motor skills of children aged 2 to 3 years, affirming that sensory stimulation is effective even for very young age groups.

According to research conducted by Insana et al. (2022), Qomariah et al. (2024), and Anwar et al. (2025), exercises involving sticking materials with various textures effectively train hand-eye coordination, finger muscle strength, and movement precision. These findings align with the principle of sensory play, which states that the use of various media textures directly provides extensive sensory stimulation to children.

According to the studies by Oktafiani & Rakimahwati (2023) and Nuraya et al. (2022), threading objects onto a string or thread trains hand-eye coordination with great precision because it requires very meticulous finger movement control. It has been proven that stringing activities are very suitable for improving children's pre-writing skills.

Utami et al. (2024) conducted a study involving finger painting using an LCD Drawing Board. This research shows that digital technology can be an effective medium for sensory play, even having additional advantages such as being easily accessible, hygienic, and more engaging for children due to its attractive digital display. With these findings, there is an opportunity to develop technology-based sensory games that align with the characteristics of digital generation children.

### ***D. The Mechanism of Sensory Play to Improve Fine Motor Skills***

Sensory play enhances children's fine motor skills using at least four main mechanisms, according to a theoretical review of various studies. First, the activation of various sensors. Based on the theory of sensory integration, Al Fathia et al. (2024) state that the more sensory stimulation a child receives, the more neural connections are formed in their brain, which aids in the development of their motor skills. Second, using repetitive exercises for small muscles. The process of squeezing, pinching, gripping, and manipulating small objects involves training the small hand muscles.

Third, thru experiential learning. According to Piaget's constructivist theory, direct experience and physical activity are the best ways for young children to learn. Fourth, the intrinsic motivation of enjoyable sensory play activities encourages children to participate actively. As a result, indirectly, the duration and intensity of motor exercises increase. This is confirmed by almost all studies showing that children's enthusiasm and participation increase during the activities.

### ***E. Factors Affecting the Effectiveness of Interventions***

The research results show several important components that influence the effectiveness of the intervention. First, the PTK research shows a more significant improvement in cycle II compared to cycle I. Second, the suitability of media with the developmental stage of 2-3-year-old children (Iswahyuni et al., 2023; Dewi, 2025) requires different stimulation from that of 4-6-year-old children. Third, Puryanti & Isnaningsih (2022) emphasize the importance of guidance from teachers or parents using Vygotsky's ZPD theory. Fourth, the research by Utami et al. (2024) found that variations and innovations in technology-based media can maintain children's interest for a longer period. Fifth, the research by Lestari & Kuswanto (2025) and Al Fathia et al. (2024) found that DIY sensory play that can be done at home is very effective when parents are active. Sixth, the selection of safe, economical, and environmentally friendly materials is very important. Research on the collage of natural materials and empty parts (Qomariah et al., 2024) shows the availability of safe and age-appropriate materials (Wathoni et al., 2024).

### ***F. Effects on Early Childhood Education Methods***

The results of this systematic review have many significant implications for how early childhood education is conducted. First, the early childhood education curriculum should be planned to integrate various types of fine motor stimulation activities, such as collage, bead threading, assembling parts, and finger painting, as part of a comprehensive fine motor stimulation program. Second, early childhood education teachers should have a strong understanding of various types of fine motor stimulation activities, as well as how to create and use media. Finally, they should know how to observe and record children's fine motor development. Third, parents should be informed about the importance of sensory play and how to do it at home with inexpensive materials. Fourth, media-based technology such as the LCD Drawing Board can still provide direct sensory experiences for digital children. Fifth, to create a comprehensive and sustainable sensory play program, teachers, parents, and experts must collaborate.

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### G. Limitations of the Reviewed Research

Although the results of the twenty-two studies are almost the same, there are some shortcomings. Most of the studies were conducted at a single institution and used relatively small samples (10-44 children), so generalizations should be made with caution. Some studies used qualitative designs, but they did not produce quantitative information about the magnitude of fine motor improvement. Almost all studies focus on motor development, but none of them evaluate the overall impact of development on other developmental components. Moreover, there is no research that specifically investigates how interventions on children's fine motor development have long-term impacts.

### IV. CONCLUSION

As a conclusion from the results of the Systematic Literature Review of twenty-two research articles published in 2021–2025, it can be concluded that various types of sensory play interventions and sensory-based activities have consistently proven effective in improving the fine motor skills of early childhood children. All twelve main types of interventions studied showed positive and significant results in improving various aspects of fine motor skills. These interventions include sensory play boxes, playdough, finger painting, messy play, magic sand, art and crafts, weaving, DIY sensory play, collages, bead threading, loose parts, and digital finger painting.

Multisensory activation mechanisms, repetitive fine motor exercises, hands-on experiential learning, and increased intrinsic motivation in children indicate that sensory play interventions are effective. The quality of guidance, the variety and innovation of activities, the age-appropriateness of the media, the frequency and consistency of stimulation, parental involvement, and the safety of materials are some components that influence success.

These findings have important implications for early childhood education. This means that teachers must be strengthened, parents must be more involved, multidisciplinary collaboration is necessary, and sensory play activities should be systematically integrated into the early childhood education curriculum. For further research, larger samples, stricter experimental designs, long-term effect analyzes, and more in-depth studies on the potential of digital technology-based sensory play to enhance early childhood fine motor skills are needed.

Recommended font sizes are shown in Table 1.

### V. TABLE

TABLE 1. CHARACTERISTICS OF THE REVIEWED ARTICLES

| No | Reviewed Articles        |                                                                              |                      |                         |                                                      |                                                                    |                             |
|----|--------------------------|------------------------------------------------------------------------------|----------------------|-------------------------|------------------------------------------------------|--------------------------------------------------------------------|-----------------------------|
|    | Author & Year            | Title                                                                        | Type of Intervention | Method of Subject       | Subject                                              | Main Outcome                                                       | Significance                |
| 1  | Ilmiyah et al. (2024)    | The Influence of the Sensory Play Box on Children's Fine Motor Skills        | Sensory Play Box     | Quasi Experiment        | 44 children, 4-5 years old Al-Mubarak Kindergarten   | Significant improvement in grasping ability, hand-eye coordination | p=0.001 < 0.05              |
| 2  | Pamungkas et al. (2023)  | The Influence of Playdough Play on Fine Motor Development                    | Playdough            | Quantitative Experiment | 15 children, 5-6 years old, BKB PAUD Cempaka Jakarta | The average increased from 29.93 to 39.53                          | p=0.001 < 0.05              |
| 3  | Faradillah et al. (2022) | The Application of Finger Painting in Developing Fine Motor Skills           | Finger Painting      | Descriptive Qualitative | Children 5-6 years                                   | Improvement in hand movement control and creativity                | Significant (descriptive)   |
| 4  | Dewi (2025)              | Analysis of Sensory Play Activities to Improve Motor Skills in 2-3 Year Olds | Varied Sensory Play  | Descriptive Qualitative | 2-3 Year Olds UNISBA Preschool                       | Improvements in gross and fine motor skills, body coordination     | Significant (descriptive)   |
| 5  | Al Fathia et al. (2024)  | Analysis of DIY Sensory Play at Home                                         | Sensory Play DIY     | Qualitative Design      | Early childhood                                      | Effective stimulation of fine motor skills; gripping,              | Effective (design analysis) |

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|    |                                                             |                                                                                                                |                                      |                                                 |                                                      |                                                                                                                                              |                                                   |
|----|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------------------------------------|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
|    |                                                             | Sensory Play DIY                                                                                               |                                      | Analysis                                        |                                                      | stringing beads, opening bottle caps                                                                                                         |                                                   |
| 6  | Rahmawati et al. (2025)                                     | Development of Playmate Sensory Media as Sensory Stimulation                                                   | Playmate Sensory                     | Qualitative Development                         | Children 3-6 years                                   | Improvement in gross motor, cognitive, social, and emotional skills holistically                                                             | Effective (development)                           |
| 7  | Nuryanah & Ramdhani (2022)                                  | Improving Fine Motor Skills thru Messy Play                                                                    | Messy Play                           | Messy Play PTK (Kemmis-Taggart)                 | 10 children, 4-5 years old, PAUD Kebumen             | Cycle I: 45-56%, Cycle II: 79-86% Significant (PTK)                                                                                          | Significant (PTK)                                 |
| 8  | Puryanti & Isnaningsih (2022)                               | The Influence of Art Craft Activities on Fine Motor Skills                                                     | Art Craft                            | One Group Experiment                            | 15 children, 4-5 years old, TK Hardikasiwi Kebumen   | Increased cutting, pasting, coloring, thickening patterns                                                                                    | t-calculated > t-table                            |
| 9  | Hidayah & Rocmah (2024)                                     | Improving Fine Motor Skills thru Sand Play (Magic Sand)                                                        | Magic Sand                           | PTK (2 Cycles)                                  | Children 4-5 years old, TK ABA Nganjuk               | Pre-cycle: 49.3%, Cycle I: 65.9%, Cycle II: 195.1%                                                                                           | Significant (PTK)                                 |
| 10 | Nisa & Aulina (2024)                                        | Improving Fine Motor Skills thru Weaving Natural Materials                                                     | Weaving Natural                      | Materials Multi-Cycle Classroom Action Research | Children 4-5 Years old, Aisyiyah Kindergarten 2 Waru | Improvement in coordination & flexibility per cycle                                                                                          | Significant (CAR)                                 |
| 11 | Tama & Rosyadah (2023)                                      | Improvement of Fine Motor Skills thru Sensory Play at Denali Palembang                                         | Sensory Play                         | Community Service                               | Early childhood,                                     | Improvement of hand-eye coordination, finger muscle strength                                                                                 | Effective (practice)                              |
| 12 | Lestari & Kuswanto (2025)                                   | The Influence of Occupational Sensory on Fine Motor Skills                                                     | Motor Skills Sensory Play DIY (home) | Qualitative Analysis                            | Early Childhood                                      | Improvement of fine motor skills thru DIY sensory play at home                                                                               | Effective (qualitative)                           |
| 13 | Iswahyuni, V., Muslihin, H., & Rahman, T. (2023)            | Development of Fine Motor Skills in 2-3 Year Old Children Thru Sensory Play at Daycare                         | Variety of Sensory Play              | Mix Method (Quantitative & Qualitative)         | 15 children, 2-3 years                               | Daycare The four types of sensory play effectively improve fine motor skills; children become more skilled at grasping and hand coordination | Effective (mix method)                            |
| 14 | Insana, S., Ismail, W., Marjuni, M., & Agusriani, A. (2022) | The Influence of Collage Activities on the Fine Motor Development of 5-6 Year Old Children                     | Collage                              | Quantitative Experiment                         | 5-6 Year Old Children                                | Kindergarten Collage activities significantly improve sticking, gripping, and hand-eye coordination                                          | The Influence of Collage Significant (experiment) |
| 15 | Oktafiani, A., & Rakimahwati, R. (2023)                     | Implementation of Beading Activities in Developing Fine Motor Skills in Early Childhood Education Institutions | Beading                              | Descriptive Qualitative                         | Early childhood                                      | ECE Beading activities train hand-eye coordination, finger muscle strength, and precise movements meaningfully                               | Effective (descriptive)                           |

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|    |                                                                   |                                                                                                                           |                                             |                                |                                                    |                                                                                                                                 |                             |
|----|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 16 | Wathoni, H., Suparmiaty, S., & Hopiah, A. M. (2024)               | Improvement of Children's Fine Motor Skills with the Loose Parts Media Approach in Playgroups                             | Loose Parts Media                           | PTK                            | Playgroup Children                                 | The use of loose parts gradually improves fine motor skills per cycle; creativity and exploration also develop                  | Significant (PTK)           |
| 17 | Qomariah, D. N., et al. (2024)                                    | Efforts to Improve Children's Fine Motor Skills Thru Collage Activities Using Natural Materials at Healthy                | Natural Material Collage                    | PTK                            | Kindergarten Children                              | Natural material collage enhances fine motor skills and creativity; children are more active and skilled in using their fingers | Significant (PTK)           |
| 18 | Anwar, H. F., Agusniatih, A., & Setianingsih, H. P. (2025)        | The Influence of Collage Activities on the Fine Motor Development of 4-5 Year Old Children at RA Alkhairaat Dupa Indah    | Collage                                     | Quantitative Experiment        | 4-5 Year Old Children                              | Fine motor Development significantly increased after the collage intervention; the ability to paste and cut improved            | Significant (experiment)    |
| 19 | Utami, W. S., Sari, F. L., & Sofyan, H. (2024)                    | The Influence of Finger Painting Using an LCD Drawing Board on the Fine Motor Skills of Children Aged 3-4 Years           | Digital Finger Painting (LCD Drawing Board) | Quantitative Experiment        | Children aged 3-4 years, KBIT Al-Muthmainnah Jambi | Finger painting with an LCD drawing board significantly improves hand-eye coordination; more engaging for children              | Significant (experiment)    |
| 20 | Febriyanti, F., Novianti, R., & Ahmad, S. (2023)                  | The Influence of Loose Parts Media on Fine Motor Development in Group B Children at PAUD Taam An Nuur Palembang           | Loose Parts Media                           | Quantitative Experiment        | Group B Children, PAUD Taame An Nuur Palembang     | Loose parts media has a positive and significant effect on fine motor skills; children's coordination and creativity improved   | Significant (experiment)    |
| 21 | Nuraya,, Nurhasanah, N., Suarta, I. N., & Astawa, I. M. S. (2022) | Development of Beading Activities to Improve Fine Motor Skills in Children Aged 4-5 Years at PAUD Mekar Sari Mataram City | Beading (Media Development)                 | Research and Development (R&D) | Children aged 4-5 years, PAUD Mekar Sari Mataram   | The developed beading media is feasible and effective in improving children's fine motor skills and concentration               | Effective (R&D)             |
| 22 | Ditha, Y. A. M., Kartika, W. I., & Heriansyah, M. (2025)          | Optimization of Fine Motor Skills in Children Aged 5-6 Years thru Finger Painting Activities                              | Activities in Finger Painting               | Quantitative (Pre-Post Test)   | Children 5-6 years                                 | Kindergarten Finger painting significantly optimizes children's fine motor skills, creativity, and self-confidence              | Significant (pre-post test) |

## VI. CONCLUSIONS

This comprehensive evaluation of the literature, which included 22 studies published between 2021 and 2025, consistently shows that sensory play-based therapies are successful in enhancing young children's fine motor abilities. Sensory play boxes, playdough, finger painting, messy play, magic sand (pasir ajaib), art craft, weaving, DIY sensory play, collage (kolase), beading (meronce), loose parts, and digital finger painting using an LCD Drawing Board were among the twelve types of interventions that produced noteworthy and favorable outcomes in a variety of fine motor development dimensions.

Eye-hand coordination, small muscle strength of the fingers and wrists, grasping and pinching capabilities, finger flexibility and movement precision, and manipulative skills like threading, cutting, and pasting are the fine motor dimensions that have increased the most consistently across studies. Four main mechanisms account for these improvements: repeated training of small muscle

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groups, multisensory activation that strengthens neural connections, experiential learning based on constructivist theory, and increased intrinsic motivation brought on by the pleasurable nature of play-based activities.

The frequency and consistency of stimulation, age-appropriate media choices, the quality of adult scaffolding, the diversity and inventiveness of activities, parental engagement at home, and the safety and accessibility of materials are important elements that impact the success of interventions. Notably, the advent of digital sensory tools, like LCD Drawing Board finger painting (Utami et al., 2024), points to a promising path for technology-integrated sensory play that is still entertaining and helps kids of the digital generation grow.

The practical implications of these findings include the systematic incorporation of a variety of sensory play activities into early childhood education (ECE) curricula, improved professional development for PAUD teachers, active parental involvement through inexpensive do-it-yourself sensory play at home, and interdisciplinary cooperation between educators, parents, and child development specialists. Larger and more varied sample sizes, rigorous experimental designs with control groups, longitudinal studies monitoring the long-term effects of sensory play interventions, and a more thorough examination of technology-based sensory media as practical tools for fine motor stimulation in early childhood settings should be the top priorities for future research.

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