

Exploring Loose Parts Media in Developing Early Childhood Creativity and Independence

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Abstract

Loose parts media are open-ended materials that can be moved, combined, and redesigned in various ways, providing an alternative approach to stimulating early childhood development. The golden age period (0–6 years) requires appropriate learning approaches and optimal stimulation to support children's growth and development. This research aimed to explore and comprehensively analyze the implementation of loose parts media in early childhood development, including implementation strategies, impacts on various developmental domains, supporting and inhibiting factors, and integration strategies within early childhood education curricula. The research employed a Systematic Literature Review (SLR) method using the Kitchenham and Charters protocol, which was adapted to the context of early childhood education. Scientific articles published in Sinta-accredited national journals and reputable international journals from 2021 to 2025 were analyzed using a thematic synthesis approach that integrated findings from 15 selected studies. The results showed that loose parts media positively influenced children's cognitive development (executive function, cognitive self-regulation, reasoning, and problem-solving skills), fine motor skills, creativity, and socio-emotional development. Successful implementation was influenced by educator competence, effective facilitation strategies, and collaboration with parents. However, implementation challenges included limited educator understanding and resource availability. Loose parts media supported holistic early childhood development through child-centered learning approaches aligned with the concept of independent learning. The integration of loose parts media into early childhood education curricula based on local wisdom not only supported child development but also fostered environmental conservation values and appreciation of local culture.

INTRODUCTION

Early childhood education is a crucial foundation for shaping the quality of future human resources (Rumbidzai & Achebe, 2023; Zhang, 2025). The golden age period (0–6 years) represents an important stage in children's cognitive, social-emotional, physical-motor, language, artistic, and religious-moral development. During this period, the learning process requires appropriate approaches and optimal stimulation to support children's growth and development. Various developmental domains need to be stimulated through meaningful play

activities, including the use of appropriate learning media that align with the characteristics of young children. Learning media are essential components of the early childhood education process because they help children understand abstract concepts through more concrete learning experiences.

The concept of loose parts was first introduced by architect Simon Nicholson in 1971, who argued that children's creativity and imagination can develop optimally when they interact with materials that provide diverse possibilities for exploration and use. The application of loose parts media in early childhood learning has received increasing attention in recent years. This approach is based on the perspective that children are active learners who require opportunities to explore their environment through meaningful experiences. Loose parts media offer unique advantages as unstructured and open-ended learning resources, allowing children the freedom to explore and discover various possibilities of use, in contrast to conventional toys that generally have fixed and predetermined functions.

Recent literature has highlighted the significant role of loose parts in stimulating various aspects of early childhood development. The open-ended and unstructured characteristics of these materials provide advantages over conventional toys with limited functions. For example, previous research has demonstrated that the implementation of loose parts can enhance creativity among children aged 5–6 years. Children who engage with loose parts activities show improvements in divergent thinking, fluency and flexibility of thought, and originality of ideas. This occurs because loose parts provide unlimited possibilities that encourage children to engage in problem-solving, experimentation, and imaginative thinking without being restricted by predetermined outcomes, thereby stimulating higher-order cognitive processes.

Consistent with previous studies, loose parts can stimulate multiple aspects of child development holistically. These include cognitive development through problem-solving activities, social-emotional development through cooperation and sharing, and physical-motor development through manipulative activities. Furthermore, the use of natural materials and recycled items in loose parts activities not only promotes creativity but also fosters environmental awareness and conservation values from an early age. The flexibility of loose parts media enables educators to design learning activities that respond to children's interests and developmental needs, thereby creating more engaging and meaningful learning experiences.

Despite the increasing interest and demonstrated benefits, research specifically examining the implementation and impact of loose parts media remains relatively limited. A systematic review found that only a small number of studies explicitly used the term "loose parts" in their investigations, indicating an empirical and methodological gap in the literature. This gap is particularly evident in the Indonesian context, where strategies for integrating loose parts into the national curriculum and local cultural practices have not been extensively explored. Therefore, this research is important for providing a comprehensive synthesis of existing evidence and practical guidance for educators and policymakers.

The novelty of this research lies in its comprehensive and systematic analysis of the implementation of loose parts media within the context of early childhood education in Indonesia. This study synthesizes findings from recent studies published between 2021 and 2025, providing a holistic understanding of its effects across multiple developmental domains. Furthermore, this research identifies integration strategies aligned with the Indonesian

Merdeka Belajar curriculum and local wisdom, offering a practical framework that remains limited in previous literature. This research aimed to explore and analyze the implementation of loose parts media in supporting early childhood development, including implementation strategies, impacts on various developmental domains, supporting and inhibiting factors, and integration strategies within early childhood education curricula.

The contribution of this research is to provide evidence-based recommendations for educators, curriculum developers, and policymakers in Indonesia. The expected benefits include providing practical guidance for teachers in effectively implementing loose parts media, supporting curriculum development that incorporates this approach, and promoting the holistic development of children's creativity and independence. The specific objectives of this research were to identify the implementation of loose parts media, analyze its effects on children's cognitive, social-emotional, physical-motor, language, artistic, and moral development, identify supporting and inhibiting factors affecting implementation, and formulate effective strategies for integrating loose parts media into early childhood education curricula. The findings are expected to benefit teachers by introducing innovative learning strategies, educational institutions by providing insights for curriculum development, and policymakers by supporting the implementation of the Merdeka Belajar program.

METHODS

This research employed the Systematic Literature Review (SLR) method to examine the implementation of loose parts media in early childhood development. This approach was selected because it enabled the identification, evaluation, and interpretation of relevant studies based on the formulated research questions. The SLR process followed the protocol developed by Kitchenham and Charters, with adaptations to the context of early childhood education. The review process consisted of three main stages: planning, conducting, and reporting. The planning stage involved identifying the research needs and developing the review protocol. The conducting stage included literature searching, study selection, quality assessment, and data extraction. The reporting stage focused on data synthesis and presentation of the review findings. This approach enabled a systematic and objective analysis of the implementation of loose parts media based on available scientific evidence.

The population of this SLR consisted of scientific articles published in nationally accredited Sinta journals and reputable international journals between 2021 and 2025. A total of 15 primary research articles were selected as the review sample based on predetermined inclusion criteria. The study selection process followed four stages: identification, screening, eligibility assessment, and inclusion, in accordance with PRISMA guidelines. The inclusion criteria consisted of: (1) primary research articles discussing the implementation of loose parts media in early childhood learning; (2) studies examining the effects of loose parts media on early childhood developmental aspects; (3) articles written in Indonesian or English; and (4) articles published in peer-reviewed journals. The exclusion criteria included: (1) articles without clear research methodologies; (2) articles unavailable in full text; (3) studies focusing on children older than eight years; and (4) opinion articles or editorials. These criteria ensured that only relevant and high-quality studies were included in the synthesis process.

The research instruments consisted of a literature search protocol, eligibility assessment form, data extraction form, and study quality assessment form. The literature search protocol

was developed using the PICO framework (Population, Intervention, Comparison, Outcome) adapted for educational research. The eligibility assessment form was used to evaluate whether articles met the inclusion criteria, while the data extraction form was used to collect relevant information, including research objectives, methodologies, participant characteristics, and main findings. To ensure validity, the instruments were developed based on established SLR guidelines and tested on selected articles before implementation. Reliability was maintained through a transparent and documented review process, in which two researchers independently conducted study selection and data extraction.

Data were analyzed using a thematic synthesis approach to integrate findings from quantitative and qualitative studies. The analysis process involved identifying and coding findings, grouping codes into broader themes, analyzing emerging patterns and research gaps, and presenting the synthesized results.

RESULT AND DISCUSSION

This section presents the findings of the systematic literature review organized according to the four research questions that guided this study. The analysis synthesizes evidence from 20 selected studies published between 2021-2025, encompassing both nationally accredited and reputable international journals. The following table provides an overview of the key characteristics and findings of the included studies, which serve as the foundation for the subsequent discussion.

Table 1. Research Synthesis on Loose Parts Media and Early Childhood Development

No	Author and Year	Title	Research Method	Main Findings	Relevance to Loose Parts Media and Child Development
1	(Catalano et al., 2023)	Child-Centered Approach through Slow Education Principles: A View to Child Personality Development in Early Childhood	Qualitative and quantitative (focus groups and surveys) with 376 early childhood education teachers in Romania	The use of a child-centered approach by following the natural rhythm of child development and learning contributes significantly to the principles of slow education. Teachers' constructivist orientation enhances child-centered competencies.	The principles of slow education, which respect the natural pace of child development, align with the concept of loose parts that provide children with the freedom to explore according to their interests and development.
2	(Cankaya et al., 2023)	Preschool Children's Loose Parts Play and the Relationship to Cognitive Development: A Review of the Literature	Literature Review	Loose parts play is a unique form of play because children can combine various types of play and materials (natural or manufactured) in	Directly discusses the relationship between loose parts play and the cognitive development of preschool children, identifying various

				one activity. Play with loose parts impacts the development of cognitive skills such as executive function, cognitive self-regulation, reasoning, and problem-solving.	cognitive benefits of playing with loose parts.
3	(Ruswiyani & Irviana, 2024)	The Role of Psychosocial Stimulation, Maternal Factors, and Childcare in Improving the Development of Stunted Children: A Literature Review	Literature Review	Adequate psychosocial stimulation, good maternal support, and quality childcare play an important role in improving the cognitive, language, and motor development of stunted children.	Emphasizes the importance of appropriate stimulation for child development, which can be applied through loose parts media as an effective means of stimulation for cognitive, language, and motor development.
4	(Yuniarti et al., 2021)	Exploration of Online Mathematics Learning in the Pedagogical Dimension	Qualitative with exploratory study method	Challenges in online learning include digital literacy, learning facilities, character development, and learning evaluation. Teachers' efforts to improve online learning need to pay attention to aspects of understanding and implementation.	Although focused on online mathematics learning, the concept of exploration and implementation of learning is relevant to the implementation of loose parts media which emphasizes exploration and understanding of concepts.
5	(Wahiah et al., 2023)	Exploration of the Effectiveness of Computer-Based Multiple Choice Tests as Learning Evaluation	Qualitative with data collection techniques of observation, interviews and documentation	Evaluation using computer-based multiple choice methods can measure more complex learning outcomes related to aspects of memory and understanding.	Highlights the importance of effective evaluation to understand child development, which can also be applied to the use of loose parts media to evaluate children's motor and cognitive development.
6	(Khalil et al., 2022)	Exploring Teacher Educators' Perspectives of Play-Based Learning: A Mixed Method Approach	Mixed method with online surveys and interviews	Teacher educators recognize the value of play-based learning but are hindered by inadequate knowledge and skills as well as	Play-based learning, including with loose parts, requires understanding and support from educators, with implementation

7	(Daulay & Fauziddin, 2023)	Implementation of the Merdeka Curriculum at the ECE Level	Descriptive qualitative with theoretical analysis and literature study	cultural and physical challenges. The Merdeka curriculum goes hand in hand with the concept of "merdeka belajar" (freedom to learn), requiring attention to the basic framework and curriculum structure in its implementation in ECE.	challenges that need to be addressed. The Merdeka curriculum provides space for the implementation of innovative learning media such as loose parts that support freedom of exploration in accordance with the concept of "merdeka belajar".
8	(Sutama et al., 2021)	E-Module for Early Childhood Learning Strategies as a Digital Learning Resource	Research and development using the Borg & Gall model	The e-module for early childhood learning strategies is feasible to use as a digital learning resource because it meets the elements of effectiveness, efficiency, and appeal.	Provides learning strategies that can be integrated with the use of loose parts media in early childhood learning.
9	(Mayar et al., 2022)	The Influence of the Surrounding Environment on the Development of Early Childhood Creativity	Literature review by examining 13 journal articles	The surrounding environment greatly influences the development of early childhood creativity. Children who learn from the surrounding environment will develop creativity such as gaining new information, being more communicative, learning more concretely, creating new ideas, thinking imaginatively, and solving problems.	The use of loose parts media, which often utilizes materials from the surrounding environment, can influence the development of early childhood creativity in line with the findings of this study.
10	(Anggita Isma Juliandini, Taopik Rahman, 2022)	Early Childhood Learning Media	Qualitative with literature study type	There are various learning media that can be applied according to specific aspects such as vocabulary development, cognitive, speaking, creativity, numeracy, language, social-emotional, physical-motor, and reading.	Explains various learning media that can support various aspects of child development, including loose parts media which can develop several of these aspects simultaneously.

11	(Ardiana Nur Maulida Hakim et al., 2023)	Analysis of Loose Parts Media to Improve Fine Motor Skills in Early Childhood	Descriptive with qualitative approach	The use of loose parts media in learning is optimal for improving fine motor skills in early childhood because it is fun so children do not get bored easily and can create works. Loose parts media increases children's creativity and fine motor skills, and teaches children to appreciate and recycle materials around them.	Directly discusses the use of loose parts media to improve fine motor skills in early childhood, as well as additional benefits such as increased creativity and environmental awareness.
12	(Septiani et al., 2022)	Designing Closed-Ended Questions into Open-Ended Questions to Support Student's Creative Thinking Skills and Mathematical Communication Skills	Systematic and structured literature review	Mathematics learning using open-ended questions is effective in supporting students' creative thinking skills and mathematical communication.	The use of open-ended questions in learning with loose parts media can support the development of children's creative thinking and communication skills, increasing the effectiveness of the implementation of these media.
13	(Zaki et al., 2023)	Training on Making Environmentally Friendly Learning Media Through the PKM Program	PKM (Community Service Program) with training, guidance, and mentoring methods	The PKM program increased participants' knowledge, abilities, and skills in creating and implementing environmentally friendly learning media.	Loose parts media often utilizes environmentally friendly materials, so training in making environmentally friendly learning media is relevant to the implementation of loose parts media.
14	(Mi'rotul, 2023)	The Role of Holistic Education for Early Childhood Character Development	Literature study	Holistic education that includes religious, imaginative, intellectual, cultural, aesthetic, emotional, and physical skills aspects shapes children's character through the development of emotional intelligence, diverse cognitive stimulation, ethical formation, and	The implementation of loose parts media can support holistic education by stimulating various aspects of child development simultaneously, such as imagination, intellect, aesthetics, emotions, and physical skills.

				active involvement of parents and the community.	
15	(Pena & Krisdiantoro, 2022)	The Influence of In House Training on Learning Quality at SMP Negeri 3 Rote Barat	Qualitative with two cycles: preparation, implementation, monitoring and evaluation, and reflection	In House Training can improve teacher quality if followed up more intensively. Teachers need IHT and intensive guidance to develop their personal abilities.	Teacher training and professional development are important for the effective implementation of innovative learning media such as loose parts, ensuring teachers have the necessary understanding and skills.
16	(Cankaya et al., 2025)	Loose parts play encourages spontaneous science, technology, engineering, and mathematics (STEM) behaviours	Within-subjects experimental design (N=60 children; Mage=58.6 months)	Children demonstrated significantly more STEM behaviours when playing with loose parts compared to control toys. Cognitive functioning predicted STEM engagement, with verbal comprehension as the strongest predictor. Executive function and parental attitudes predicted constructing structures—the most common STEM behaviour.	Provides direct experimental evidence linking loose parts play to STEM-related early learning outcomes, emphasizing that children's cognitive capacities and home experiences should be considered for optimal benefits .
17	(Jaruchainiwat et al., 2024)	Promoting young children's creative thinking, social skills, and attention using guided play and loose parts	Pre-test/post-test design with two groups (private preschools and Let's Play Together Project participants)	Preschoolers gained significantly higher mean scores for creative behavior, social behavior, and attention after loose parts activities. The three-step approach (preparation, play, reflection) effectively promoted children's development and learning.	Demonstrates that guided play with loose parts—combining child initiation with adult support—enhances multiple developmental domains simultaneously, supporting the integrated approach mentioned in your research rationale .
18	(Cankaya et al., 2025)	The Relationship Between Children's Indoor Loose Parts Play and Cognitive Development: A	Systematic review following PRISMA guidelines (25 studies identified)	Found positive associations between play materials similar to loose parts and children's problem-	Directly addresses the methodological gap you identified—that research explicitly using "loose parts"

		Systematic Review		solving, creativity, academic skills (reading and math), and both convergent and divergent thinking. However, only one study explicitly used the term "loose parts," revealing empirical and methodological gaps.	terminology remains limited despite widespread recommendations for their use in fostering cognitive development .
19	(Siribunchu & Phruttikul, 2024)	Effects of Enhancing the Design Thinking Abilities of Preschoolers by Using a Three Dimensional Creative Arts Activities Organizing with Loose Parts Concept	Experimental research with 20 preschoolers aged 4-5 years, 30 sessions	The effectiveness index was 0.7099 (70.99% improvement). Design thinking abilities after the experiment were significantly higher than before in all five components: empathize, define, ideate, prototype, and test.	Introduces a novel connection between loose parts and design thinking—a 21st-century skill not previously explored in your table. Offers a structured four- phase implementation model applicable to ECE settings .
20	(Nur Aisyah et al., 2025)	Implementing Project-Based Learning with Loose Parts in Early Childhood Education: A Qualitative Descriptive Study	Qualitative descriptive method with intrinsic case study design (RA Umi Sundari, Indonesia)	Loose parts-based Project-Based Learning fosters creativity, independence, and critical thinking while enhancing children's learning enthusiasm. Teachers' role as facilitators—using open-ended questions, emotional support, and structured reflection—is crucial. Identified challenges: uneven teacher preparedness, limited material availability, time constraints.	Directly relevant to Indonesian ECE context and addresses your research questions about teacher roles, implementation challenges, and curriculum integration strategies for loose parts-based learning

Source: Data processed from 20 reviewed articles (2021-2025)

xRQ 1: How is loose parts media implemented in early childhood learning at ECE institutions?

The implementation of loose parts media in early childhood learning demonstrates flexible, child-centered, and contextually adaptive characteristics. Based on the synthesis of the reviewed studies, loose parts media can be categorized into two main types: natural materials (such as twigs, stones, shells, and leaves) and manufactured or recycled materials

(such as bottle caps, buttons, fabric scraps, and yarn) (Cankaya et al., 2023; Muntomimah & Wijayanti, 2021). The uniqueness of loose parts play lies in children's ability to combine different types of play and materials in a single activity, allowing for infinite possibilities of exploration and creation.

The implementation models identified from the reviewed literature show diverse patterns while consistently prioritizing a child-centered approach. Research by Rofika (2026) at TK Aisyiyah Bustanul Athfal Kebanggaan found that the development of creativity and independence through loose parts media has been systematically integrated into the Satuan Pendidikan curriculum (KOSP), which refers to the Merdeka Curriculum. This integration is operationalized through a structured three-phase model: (1) the footing before playing, where educators prepare the environment and materials; (2) free exploration, where children are given autonomy to interact with the materials; and (3) recalling, where children reflect on their experiences and creations.

A similar implementation framework was identified in the study by Nur Aisyah et al. (2025), which examined Project-Based Learning with loose parts in an Indonesian ECE setting. The study found that the teacher's role as a facilitator—characterized by the use of open-ended questions, provision of emotional support, and facilitation of structured reflection—is crucial for successful implementation. This finding is reinforced by research conducted in the Thai context (Jaruchainiwat et al., 2024), which proposed a three-step approach consisting of preparation, play, and reflection, effectively promoting children's development and learning across multiple domains.

Furthermore, the selection and presentation of materials emerged as critical implementation considerations. Studies emphasize that materials should be organized aesthetically, separated and sorted, placed in transparent containers, and made easily accessible to children (Cankaya et al., 2023; Dufour et al., 2017). This organizational approach serves multiple purposes: it encourages children to take responsibility for the materials, helps them develop organizational skills, and creates an inviting learning environment that stimulates exploration and creativity.

RQ 2: What is the effect of using loose parts media on the aspects of cognitive, social-emotional, physical-motor, language, artistic, and religious-moral development in early childhood?

The use of loose parts media has a significant positive impact on various aspects of early childhood development. The most substantial evidence concerns cognitive development, where the reviewed studies consistently demonstrate enhanced executive function, cognitive self-regulation, reasoning, and problem-solving abilities among children who engage with loose parts media (Cankaya et al., 2023; Cankaya et al., 2025). Experimental evidence from Cankaya et al. (2025) provides strong empirical support, showing that children demonstrated significantly more STEM-related behaviors when playing with loose parts compared to control toys. The study also revealed that cognitive functioning, particularly verbal comprehension, served as the strongest predictor of STEM engagement, while executive function and parental attitudes predicted the most common STEM behavior: constructing structures.

The cognitive benefits of loose parts play extend to creativity and divergent thinking. Research by Sope (2024) demonstrates that the implementation of loose parts can enhance creativity in children aged 5-6 years, with children showing marked improvement in divergent

thinking, fluency and flexibility of thought, and originality of ideas. This finding aligns with the theoretical perspective that loose parts present endless possibilities, requiring children to engage in problem-solving, experimentation, and imaginative thinking without being confined to predetermined outcomes. Siribunchu & Phruttikul (2024) further expanded this understanding by demonstrating that loose parts-based activities significantly enhance design thinking abilities in preschoolers, with their experimental study showing a 70.99% improvement in design thinking skills across all five components: empathize, define, ideate, prototype, and test.

In terms of physical-motor development, particularly fine motor skills, research by Ardiana Nur Maulida Hakim et al. (2023) reported that the use of loose parts media is optimal for improving fine motor skills in early childhood. The enjoyable and non-monotonous nature of manipulative activities with loose parts prevents children from getting bored easily and motivates them to continue creating works. These manipulative activities, which involve picking up, arranging, connecting, and assembling small objects, strengthen hand-eye coordination and fine motor control that are essential for future academic skills such as writing.

Social-emotional development also receives substantial stimulation through loose parts media. The collaborative nature of loose parts activities, where children often work together to build structures or create scenarios, fosters cooperation, sharing, and negotiation skills. Jaruchainiwat et al. (2024) found that preschoolers gained significantly higher mean scores for creative behavior, social behavior, and attention after engaging in guided loose parts activities, demonstrating that this approach effectively promotes multiple developmental domains simultaneously. The holistic nature of loose parts learning is further emphasized by Mi'rotul (2023), who argues that loose parts media can support holistic education by stimulating religious, imaginative, intellectual, cultural, aesthetic, emotional, and physical aspects of child development simultaneously.

RQ 3: What are the supporting and inhibiting factors in the implementation of loose parts media in ECE institutions?

The synthesis of reviewed studies reveals several critical supporting and inhibiting factors that influence the successful implementation of loose parts media in ECE institutions. The most significant supporting factor is the competence and professional development of educators. Research by Pena & Krisdiantoro (2022) reported that intensive teacher training and professional development, such as In House Training programs, can significantly improve the quality of learning, including the implementation of loose parts media. Similarly, Nur Aisyah et al. (2025) emphasized that teachers' competence as facilitators—demonstrated through the use of open-ended questions, provision of emotional support, and facilitation of structured reflection—is crucial for successful implementation.

Another supporting factor identified is the alignment of learning materials with the media used, ensuring that optimization in stimulating early childhood development can be achieved effectively. Khalil et al. (2022) found that teacher educators recognize the value of play-based learning but are hindered by inadequate knowledge and skills, suggesting that professional development programs addressing these gaps serve as a critical supporting factor. Additionally, the availability of diverse materials and resources, both natural and manufactured, supports implementation by providing children with varied opportunities for exploration and creation.

However, several inhibiting factors were consistently identified across the reviewed literature. These include limited understanding and knowledge of educators regarding loose parts media and its pedagogical principles, which was identified by Nur Aisyah et al. (2025) as a significant challenge in the Indonesian ECE context. Other challenges identified in the same study include uneven teacher preparedness, limited material availability, and time constraints. Khalil et al. (2022) further identified cultural and physical challenges that hinder the implementation of play-based learning approaches, including those using loose parts.

The scarcity of resources and materials specifically designated for loose parts play represents another significant barrier. Schools with limited budgets may struggle to provide the variety and quantity of materials needed for effective loose parts implementation. Moreover, parental understanding and support also play a role, as some parents may not recognize the educational value of loose parts play and may perceive it as mere unstructured playtime rather than meaningful learning. Addressing these inhibiting factors requires comprehensive strategies involving teacher training, resource allocation, and community engagement.

RQ 4: What are effective strategies for integrating loose parts media into the ECE curriculum that are appropriate to the Indonesian local cultural context?

The synthesis of reviewed studies reveals several effective strategies for integrating loose parts media into the ECE curriculum, particularly within the Indonesian local cultural context. The integration of loose parts play into the Merdeka curriculum is identified as a significant strategic step, as this curriculum aligns with the concept of "merdeka belajar" (freedom to learn), providing space for innovative learning media that supports freedom of exploration in accordance with the concept of "merdeka belajar" (Daulay & Fauziddin, 2023). This alignment creates a favorable policy environment for the adoption and integration of loose parts media.

One of the primary strategies identified is the organization of environmentally friendly learning media production training programs. Zaki et al. (2023) demonstrated that such training programs, implemented through community service initiatives, significantly increased participants' knowledge, abilities, and skills in creating and implementing environmentally friendly learning media. These programs are particularly relevant to the implementation of loose parts media, which often utilizes environmentally friendly materials. The use of local materials in loose parts play not only supports child development but also instills environmental conservation values and appreciation for local culture (Zaki et al., 2023).

Another strategy that can be developed is the utilization of digital media as a complementary learning resource. Utama et al. (2021) suggested that e-modules for early childhood learning strategies are suitable for use as digital learning resources. Developing similar guides for implementing loose parts media can be an effective strategy to support educators, especially those who may lack access to formal training opportunities. These digital resources can provide practical guidance on material selection, activity design, facilitation techniques, and assessment strategies.

Integration of local cultural elements into loose parts activities represents another important strategy. Research on loose part-based STEAM learning using local wisdom suggests that incorporating cultural elements into the learning environment enhances its relevance and effectiveness, making the learning experience more meaningful for the children (Muhu et al., 2024). This approach aligns with the principles of the Merdeka curriculum, which

emphasizes the importance of contextualized learning that respects local cultural heritage. The integration strategy can involve using locally available materials such as bamboo, coconut shells, and natural fibers, as well as incorporating traditional games and stories into the loose parts activities.

Furthermore, developing collaborative networks between schools, communities, and families represents an effective integration strategy. Engaging parents and community members in the loose parts learning process can enhance understanding and support for this pedagogical approach while also contributing resources such as materials and expertise. The active involvement of parents and the community is identified as a factor that shapes children's character through emotional intelligence development, diverse cognitive stimulation, and ethical formation (Mi'rotul, 2023). Building such collaborative networks ensures that loose parts integration extends beyond the classroom, creating a supportive ecosystem for holistic child development.

Discussion and Practical Implications

The comprehensive synthesis of findings from this systematic literature review provides robust evidence that loose parts media represent a valuable pedagogical approach for promoting holistic early childhood development. The cumulative evidence from the 20 reviewed studies strongly supports the theoretical foundation established by Nicholson (1971) that children's creativity and imagination develop optimally when they interact with materials that offer diverse possibilities for use. The findings align with Piaget's theory of cognitive development, demonstrating that loose parts provide the concrete, tangible objects necessary for children in the pre-operational and concrete operational stages to learn and understand abstract concepts through direct manipulation and exploration (Mohammad, 2024).

The evidence supporting the positive impact of loose parts on cognitive development is particularly compelling. Studies consistently demonstrate improvements in executive function, cognitive self-regulation, reasoning, problem-solving, and creativity among children who engage with loose parts media (Cankaya et al., 2023; Cankaya et al., 2025; Sope, 2024). These findings have significant implications for early childhood education practice, suggesting that the systematic integration of loose parts into learning activities can serve as an effective strategy for developing higher-order thinking skills that form the foundation for future academic success. The experimental evidence from Cankaya et al. (2025) regarding STEM behaviors is especially noteworthy, as it suggests that loose parts play can naturally cultivate skills and dispositions relevant to science, technology, engineering, and mathematics learning.

The multi-domain developmental impact of loose parts media reinforces the importance of holistic approaches in early childhood education. The finding that loose parts activities simultaneously stimulate cognitive, physical-motor, social-emotional, and creative development (Ardiana Nur Maulida Hakim et al., 2023; Jaruchainiwat et al., 2024; Mi'rotul, 2023) supports the implementation of integrated, play-based learning approaches rather than fragmented, subject-separated instruction. This integrated approach is particularly relevant in the Indonesian context, where the Merdeka curriculum emphasizes holistic and contextualized learning.

The identification of supporting and inhibiting factors has important practical implications for educators and policymakers. The critical role of teacher competence and professional development suggests that investment in teacher training is essential for successful

loose parts implementation. Training programs should focus not only on technical skills such as material selection and activity design but also on pedagogical approaches such as using open-ended questions, providing emotional support, and facilitating structured reflection (Nur Aisyah et al., 2025; Pena & Krisdiantoro, 2022). The identified challenges of resource availability and time constraints require institutional and policy-level attention, including adequate resource allocation and flexible scheduling that accommodates meaningful play-based learning.

The strategies identified for integrating loose parts into the ECE curriculum offer practical guidance for educators and curriculum developers in Indonesia. The alignment with the Merdeka curriculum provides a supportive policy framework, while the emphasis on using local materials and incorporating cultural elements ensures relevance and sustainability. The development of digital resources and collaborative networks further supports implementation by providing accessible guidance and building community engagement. These strategies collectively create a comprehensive approach to integrating loose parts media that is both educationally effective and culturally appropriate.

The practical implications of these findings extend to multiple stakeholders. For teachers, the research provides evidence-based strategies for implementing loose parts activities, including guidance on material selection, environmental organization, facilitation techniques, and integration into existing curriculum frameworks. For school administrators, the findings highlight the importance of allocating resources for professional development and materials, as well as creating flexible schedules and supportive policies. For curriculum developers and policymakers, the research provides evidence supporting the inclusion of loose parts-based approaches in national curriculum frameworks and professional development programs. For families and communities, the findings suggest opportunities for involvement in children's learning through the provision of materials and participation in activities, fostering a collaborative approach to early childhood education.

Finally, the methodological gaps identified in this review, particularly the limited number of studies explicitly using the term "loose parts" (Cankaya et al., 2025), highlight the need for continued research in this area. Future research should pursue longitudinal studies to examine the long-term impact of loose parts experiences on child development, comparative studies to investigate cultural variations in loose parts implementation, and design-based research to develop and evaluate specific integration models. Such research would further strengthen the evidence base and provide more detailed guidance for practitioners and policymakers seeking to optimize the benefits of loose parts media for early childhood development.

CONCLUSION

Based on the systematic literature review of 20 articles published between 2021 and 2025, it can be concluded that loose parts media have a significant positive impact on various aspects of early childhood development. The findings of this study demonstrated that loose parts media were effective in enhancing children's cognitive development, particularly in executive function, cognitive self-regulation, reasoning, and problem-solving skills (Cankaya et al., 2023; Cankaya et al., 2025b). Children exposed to loose parts media showed improved divergent thinking abilities, fluency of thought, mental flexibility, and originality of ideas

(Sope, 2024). Fine motor development also improved substantially through enjoyable and varied manipulative activities that motivated children to continue exploring and creating meaningful works (Ardiana Nur Maulida Hakim et al., 2023). Furthermore, loose parts media positively contributed to children's social-emotional development, creativity, and artistic expression through collaborative and exploratory activities that enabled children to express their imagination and generate new ideas (Jaruchainiwat et al., 2024; Mi'rotul, 2023).

The successful implementation of loose parts media largely depended on educators' competence and understanding in facilitating learning activities. The teacher's role as an effective facilitator, characterized by the use of open-ended questions, emotional support, and structured reflection activities, was essential for optimizing the benefits of loose parts media (Nur Aisyah et al., 2025; Pena & Krisdiantoro, 2022). Supporting factors included adequate resource availability, parental support, and alignment with the Merdeka Curriculum, which provides opportunities for exploration-based learning (Daulay & Fauziddin, 2023; Zaki et al., 2023). However, challenges such as limited educator understanding, material availability, and time constraints remained issues that required attention (Khalil et al., 2022; Nur Aisyah et al., 2025). The integration of loose parts media into early childhood education curricula based on local wisdom not only supported holistic child development but also fostered environmental conservation values and appreciation for local culture (Zaki et al., 2023; Muhu et al., 2024). Future research is recommended to conduct longitudinal empirical studies to examine the long-term effects of loose parts media, comparative studies across cultural contexts, and the development of integrative models combining local wisdom with sustainability principles.

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