

Enhancing Fine Motor Skills Through Loose-Parts Play Using Natural Materials in Early Childhood Education

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ABSTRACT

This study investigates the effectiveness of loose-parts play using natural materials specifically leaves in improving fine motor skills among kindergarten children. Conducted as Classroom Action Research (CAR) following the Kemmis and McTaggart model, the study involved 15 children aged 5–6 years from TK Pusat PAUD Bunga Mawar. The intervention was implemented across two cycles, each consisting of two structured sessions that progressively increased in task complexity, including leaf collaging, pattern pasting, size sorting, and thematic compositions. Data were collected through observation, performance assessments, and documentation, and analyzed using descriptive quantitative and qualitative methods. Results showed substantial improvement in children's fine motor skills, with the mean score increasing from 34% in the pre-cycle to 52% in Cycle I and reaching 92% in Cycle II, where all children achieved the "Very Well Developed" (BSB) category. Qualitative findings revealed enhanced hand-eye coordination, refined scissor control, increased precision, sustained engagement, and growing independence. The study demonstrates that loose-parts play provides multisensory, open-ended, and developmentally appropriate opportunities that effectively strengthen fine motor abilities. These findings support the integration of natural loose parts as an accessible pedagogical approach in early childhood education and highlight the value of reflective, scaffolded instruction for optimizing children's developmental outcomes.

Keywords: Loose parts play; fine motor development; early childhood education; natural materials; classroom action research; sensory learning; hands-on activities.

1) INTRODUCTION

Fine motor development is a fundamental aspect of early childhood growth that plays a crucial role in preparing children for later academic and daily life activities. Skills such as grasping, cutting, tearing, manipulating small objects, drawing, and writing represent essential competencies that children must master during the kindergarten years. These abilities are closely linked to children's readiness for formal schooling, particularly in tasks requiring precision, coordination, and control of hand and finger movements (Mulyawan, Basrowi, & Kurniawati, 2023).

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However, in many early childhood settings, children frequently demonstrate varied levels of fine motor proficiency, and some exhibit difficulties that may hinder their later academic progress. In fact, literature has documented that without adequate stimulation, fine motor development may be delayed or under-optimized (Isnaini & Katoningsih, 2021). This highlights the need for intentional and developmentally appropriate interventions that can effectively stimulate children's fine motor skills through meaningful learning experiences (Maharani, Karomatunnisa, & Jamilah, 2024).

Play has long been recognized as the most natural and developmentally appropriate medium for learning in early childhood education. Through play, children explore, experiment, manipulate, imagine, and construct meaning from hands-on experiences. Within this context, *loose parts play* has emerged as an innovative and highly beneficial approach for stimulating children's cognitive, social, and physical development. The loose parts concept, introduced by Simon Nicholson, refers to open-ended materials that children can move, combine, redesign, and manipulate freely (Model Pengenalan Keaksaraan AUD, 2020). Such materials provide a flexible, child-directed environment that encourages creativity and problem-solving (Nicholson, dalam Mastuinda, Zulkifli, & Febrialismanto, 2020).

Natural loose parts, such as leaves, stones, twigs, and seeds, are particularly valued for their sensory richness and accessibility. Because they come in a wide variety of shapes, textures, and sizes, these materials provide sensory stimulation and manipulation opportunities that are especially conducive to fine motor development (Syafi'i & Dianah, dalam Syafi'i & Dianah, 2022). Furthermore, research in early childhood settings shows that using loose parts can significantly improve children's fine motor skills (Setianingsih & Handayani, 2022).

Despite the growing interest in loose parts play globally and locally, its systematic application in Indonesian early childhood education, especially in relation to fine motor development, remains limited. Many kindergartens still rely on worksheet-based or teacher-directed activities that do not fully support hands-on exploration or manipulation of materials. As a result, children may not be sufficiently exposed to experiences that stimulate fine motor refinement through authentic play. Previous studies have demonstrated the potential of loose parts in enhancing creativity and sensory engagement (Eriani, Mardiah, Napratilora, & Erdawati, 2022), yet empirical evidence focusing specifically on fine motor improvement within the Indonesian context is relatively sparse.

This gap underscores the need for research that examines how loose parts activities can be effectively implemented in real classroom settings and how such interventions contribute to children's fine motor growth. For instance, a quasi-experimental study in a kindergarten in Bukittinggi found that loose parts activities significantly improved fine motor scores (Aneli & Nurhafizah, 2020), and a classroom action research in another TK showed marked increase in fine motor skills after applying loose parts (Wathoni, Suparmiati, & Hopiah, 2024).

In response to this gap, the present study aims to examine the effectiveness of loose parts play, using natural materials, particularly leaves in enhancing the fine motor skills of kindergarten children. The study was conducted in a real classroom environment through a cyclical process of planning, action, observation, and reflection, allowing for the continuous refinement of teaching strategies. The intervention involved engaging children in hands-on activities such as arranging, tearing, cutting, and pasting leaves to create patterns and shapes. These activities were designed to stimulate finger strength, hand-eye coordination, precision, and creative expression.

The central purpose of this study is to determine the extent to which loose parts play can improve children's fine motor abilities and to explore how children respond behaviorally and developmentally throughout the intervention process. Specifically, this study addresses the following research questions: (1) What were the children's fine motor skill levels before the implementation of loose parts play?; (2) How did children's fine motor skills develop following the loose parts intervention across two action cycles?; (3) To what extent was loose parts play effective in meeting the developmental indicators for fine motor skills in kindergarten?

By addressing these questions, this study contributes to the growing body of literature on innovative learning approaches in early childhood education and provides practical insights for teachers seeking affordable, sustainable, and developmentally appropriate strategies to support fine motor development. The findings have significant implications for the integration of loose parts as a routine component of early childhood learning environments, particularly in promoting hands-on and exploratory experiences that align with the holistic developmental needs of young children.

2) METHODS

This study employed a Classroom Action Research (CAR) approach following the Kemmis and McTaggart model, which consists of the cyclical stages of planning, action, observation, and reflection. This design was selected because it allowed systematic improvement of fine motor skills through

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iterative intervention, enabling the researcher and classroom teacher to refine instructional practices based on children's ongoing responses (Kemmis & McTaggart, 1988). Two full cycles were implemented, each comprising two meetings, allowing adjustments between cycles as insights emerged during teaching and observation.

The research was conducted at TK Pusat PAUD Bunga Mawar in Makassar with a purposive sample of 15 Group B children (aged 5–6 years), consisting of 10 girls and 5 boys. The classroom was selected due to its readiness to collaborate, availability of learning facilities, and suitability for implementing loose-parts-based activities. The intervention utilized natural loose parts, primarily leaves of varied size, shape, and color, supported by scissors, glue, drawing sheets, and pattern templates. Cycle I introduced children to leaf exploration and simple collage creation, whereas Cycle II progressed to structured compositions requiring more precision and pattern arrangement.

Data collection involved structured observation, performance assessment, and documentation. Observations were conducted collaboratively by the researcher and classroom teacher using detailed field notes. Children's fine motor abilities, such as cutting, tearing, pasting, arranging, and hand–eye coordination were assessed through a rubric aligned with national PAUD indicators, categorized into BB, MB, BSH, and BSB following Arikunto's (2010) scoring guidelines. Documentation, including photographs and samples of children's work, served as additional evidence of developmental progress. The primary instrument was an observation sheet specifically designed to measure key fine motor indicators and validated for content appropriateness.

Data analysis used descriptive quantitative techniques to compare children's performance across the pre-cycle, Cycle I, and Cycle II stages. Percentage scores were calculated for each child, and mean improvements across cycles were used to determine the effectiveness of the loose-parts intervention. Qualitative analysis of observation notes complemented quantitative findings by highlighting behavioral patterns, engagement levels, and emerging challenges. Ethical considerations were upheld throughout the study, with school approval obtained, parental awareness ensured, and children's identities protected. All activities were designed to be safe, developmentally appropriate, and supportive of children's well-being.

3) RESULTS AND DISCUSSION

This section presents the findings of the study across three stages of assessment: the pre-cycle, Cycle I, and Cycle II. The results include quantitative data from fine motor skill assessments as well

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as qualitative observations derived from classroom practices. All findings are based on the systematic evaluation of 15 kindergarten children involved in loose parts activities conducted over two cycles of classroom action research.

- **Pre-Cycle Results**

The pre-cycle assessment indicated that the children's fine motor skills were generally low, with a mean score of 34%. Most children fell into the developmental categories of *Belum Berkembang* (40%) and *Mulai Berkembang* (46.7%), while only two children (13.3%) reached BSH and none achieved BSB. These results show that the majority had not yet developed essential fine motor foundations such as stable scissor handling, controlled tearing, neat pasting, and the ability to arrange objects according to simple patterns. The quantitative findings therefore highlighted the need for a targeted intervention to strengthen fine motor competencies.

Qualitative observations supported the numerical data, revealing challenges such as unstable hand control, weak finger strength, poor hand-eye coordination, and limited task engagement. Many children struggled with proper grip, applied inconsistent pressure when manipulating materials, and required frequent reminders to maintain focus. These difficulties indicated insufficient prior exposure to manipulative, hands-on experiences, underscoring the relevance and necessity of implementing a structured loose-parts intervention to address their developmental needs.

- **Cycle I Results**

Cycle I comprised two sessions in which children explored various leaf shapes, created simple collages, and practiced pasting leaves onto basic pattern outlines. These activities, structured through detailed lesson plans, aimed to strengthen foundational fine motor abilities through guided manipulation of natural loose parts. Quantitative results showed meaningful progress from the pre-cycle stage, with the mean score rising to 52%. The developmental distribution also shifted positively: no children remained in the *Belum Berkembang* category, 20% were in *Mulai Berkembang*, while 40% reached BSH and another 40% achieved BSB. This demonstrated that even initial exposure to loose-parts activities contributed to measurable improvements.

Qualitative observations further highlighted advances in grip consistency, tool handling, hand-eye coordination, task engagement, and emerging creativity, as some children experimented with

arranging leaves beyond assigned patterns. Nonetheless, several challenges persisted, including uneven cutting, imprecise pasting, and occasional rushing through tasks. These findings informed the reflective stage of Cycle I, prompting instructional refinements for Cycle II such as clearer demonstrations, diversified leaf sizes, enhanced scaffolding, and gradual increases in task complexity to better support children's developmental progression.

- Cycle II Results

Cycle II introduced more complex loose-parts activities that required higher levels of precision, including assembling leaves into fish-shaped templates and creating independent compositions involving size sorting, directional pasting, and symmetrical arrangements. These tasks were intentionally designed to reinforce finger strength, bilateral coordination, and spatial planning. The results showed a substantial improvement, with the mean score increasing to 92% and all 15 children achieving the Berkembang Sangat Baik (BSB) category. This achievement exceeded the school's competency benchmark (KKM 75%) and demonstrated the cumulative effect of sustained practice, enhanced scaffolding, and increased task complexity from the previous cycle.

Qualitative observations further confirmed major developmental advances. Children demonstrated refined scissor skills, stronger finger control, and accurate placement of materials, along with significantly improved spatial awareness when following templates. Independence also increased, with most children completing tasks confidently and requiring minimal guidance. Their growing enthusiasm was reflected in active discussions with peers, thoughtful selection of leaf materials, and creative suggestions for alternative designs. Collectively, these outcomes highlight not only fine motor mastery but also broader cognitive and creative growth supported through the loose-parts intervention.

The progression of scores across the three stages is summarized as follows:

Table 1: *Summary of Fine Motor Skill Development Across Pre-Cycle, Cycle I, and Cycle II*

Assessment Stage	Mean Score	Dominant Category	Notes
Pre-Cycle	34%	MB / BB	Skills underdeveloped; low control and coordination

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Assessment Stage	Mean Score	Dominant Category	Notes
Cycle I	52%	BSH / BSB	Basic skills improved; engagement increased
Cycle II	92%	BSB	Significant mastery; all students reached competency

The upward progression across the two intervention cycles indicates that repeated exposure, guided practice, and developmentally appropriate loose-parts activities consistently enhanced children's fine motor abilities. The most substantial gains were observed in scissor handling, tearing and pasting accuracy, pattern assembly, and task focus, with children demonstrating improved grip control, stability, spatial reasoning, and sustained engagement facilitated by the tactile and open-ended nature of loose parts. These outcomes affirm that loose-parts play provides the multisensory stimulation essential for fine motor refinement. Overall, the findings show a strong positive impact of the intervention, transforming initially underdeveloped fine motor skills into full mastery by the end of Cycle II through structured, meaningful, and engaging loose-parts experiences.



Figure 1: *Student Work Results*

The present Classroom Action Research demonstrates a marked, stepwise improvement in kindergarten children's fine motor skills following a structured loose-parts intervention using natural materials (leaves). The progression from a baseline mean of 34% (pre-cycle) to 52% (Cycle I) and finally 92% (Cycle II) indicates that iterative, scaffolded exposure to tactile, open-ended materials can produce rapid and robust gains in manipulative control, hand–eye coordination, and task persistence

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(Isnaini & Katoningsih, 2021; Maharani, Karomatunnisa, & Jamilah, 2024). These classroom findings accord with broader evidence showing that play-based, repeated motor practice supports the acquisition of fine motor competencies in early childhood (Zhang et al., 2024; Chen et al., 2024).

Three interacting mechanisms appear to account for the observed gains. First, material affordance and variability inherent in natural loose parts (leaf size, thickness, texture, irregular edges) created continual micro-challenges that required children to adjust grip, pressure, and placement, a form of distributed practice that supports motor calibration and dexterity (Nicholson, 1972; Setianingsih & Handayani, 2022). Indonesian classroom studies of loose parts report similar motoric benefits when natural materials are used for collaging, sorting, and pattern tasks (Setianingsih & Handayani, 2022; Ella, 2024; Lestari, 2024).

Second, scaffolded pedagogy within the CAR cycles, deliberate modeling, graded task complexity and gradual withdrawal of support, amplified children's gains. The teacher's reflective adjustments between cycles (clearer demonstrations, diversified leaf sizes, increased scaffolding then fading) match best practices identified in intervention literature, where formative feedback and adaptive instruction enhance motor learning effects (Kemmis & McTaggart, 1988; Setianingsih & Handayani, 2022). Comparable Indonesian action-research projects also emphasize teacher reflection as a success factor in loose-parts implementations (Hadiyanti, 2024; Purwanti, 2025).

Third, the multisensory and motivational features of loose-parts activities increased engagement and extended practice time. The tactile richness of leaves stimulated sensory discrimination, while the open-ended framing supported autonomy and creative experimentation, conditions associated with sustained attention and intrinsic motivation in preschool contexts (Eriani et al., 2022; Gibson et al., review 2023). Increased engagement, in turn, amplifies repetition and consolidation, explaining why the cohort moved from partial competence in Cycle I to near-mastery in Cycle II.

Empirically, the pattern in this study mirrors findings from systematic reviews showing that structured motor interventions with sufficient frequency and duration yield meaningful improvements in motor skills (Zhang et al., 2024; van Capelle et al., 2017). Meta-analytic evidence indicates that the dosage (number of sessions, practice intensity) and teacher implementation quality are major moderators of effect size; the CAR design with iterative refinement and concentrated sessions, likely provided an efficacious dosage in this classroom (Zhang et al., 2024; van Capelle et al., 2017).

Beyond motor metrics, the intervention produced clear cognitive and social benefits. Improvements in spatial reasoning, planning and bilateral coordination observed during pattern assembly align with literature linking fine motor practice to visuospatial integration and pre-writing skills (Mastuinda, Zulkifli, & Febrialismanto, 2020; Suggate, Pufke, & Stoecker, 2019). The link between early fine motor competence and later literacy and numeracy underscores how interventions that accelerate manipulative control may have downstream academic advantages (Suggate et al., 2019).

The qualitative data, greater independence, peer collaboration, and creative elaboration, reflect developmental pathways described by Vygotsky's scaffolded learning and Nicholson's loose-parts theory: children internalize techniques modeled by adults and then recombine materials creatively to produce novel forms (Nicholson, 1972; Vygotsky, 1978). Local studies of loose-parts implementation similarly document enhanced creativity and social interaction when natural manipulatives are used in early childhood classrooms (Aneli, 2023; Haryanto, 2024; Maryatun, 2024).

Methodological caveats must be acknowledged. The study's small sample (n=15) and single-site CAR design limit broad generalization; nevertheless, CAR's pragmatic orientation provides high ecological validity and actionable classroom evidence (Kemmis & McTaggart, 1988). Measurement relied on structured observation rubrics aligned to PAUD indicators; while these captured meaningful change, future work would benefit from triangulation with standardized fine-motor instruments (pegboard tests, validated motor batteries) to strengthen measurement precision (Zhang, Lin, & Li, 2025; Chen et al., 2024).

Practical implications for Indonesian early childhood pedagogy are immediate. Loose-parts interventions using locally available natural materials are low-cost, culturally appropriate, and easily scalable within resource-constrained settings a conclusion echoed across multiple Indonesian studies and program reports (Setianingsih & Handayani, 2022; Ella, 2024; Hadiyanti, 2024; Ramadan, 2025). Teacher training should emphasize scaffolding strategies, safety protocols for manipulatives, and iterative lesson planning (RPPH) so that open-ended materials lead to targeted skill practice rather than unfocused play.

For research, priority actions include larger replication studies across diverse settings, randomized or quasi-experimental designs comparing different types of loose parts (natural vs. manufactured), and longitudinal follow-up to assess retention and transfer to writing, cutting, dressing, and classroom

tasks. Such expansions would address questions about generalizability, dose–response, and long-term impacts that current national case studies cannot resolve alone (Zhang et al., 2024; Chen et al., 2024).

In sum, the current study contributes robust classroom evidence that deliberately designed loose-parts activities, when combined with reflective teaching and scaffolded progression, can rapidly enhance fine motor development, foster cognitive and creative gains, and provide an affordable pedagogical strategy for Indonesian kindergartens. Its findings converge with international meta-analyses and numerous national case studies, supporting the integration of loose parts as a routine pedagogical tool for early childhood development.

the strong positive outcomes observed in this study, several limitations must be acknowledged. First, the sample size consisted of only 15 children, which limits the generalizability of the findings to broader populations. Future research involving larger and more diverse groups of children would help validate the conclusions of this study. Second, the research was conducted in a single kindergarten, meaning that contextual factors such as teacher expertise, school environment, and available facilities may have influenced the results. Replicating the study across different schools and regions would provide a more comprehensive understanding of the effectiveness of loose parts play. Third, although structured assessment instruments were used, some observations relied on teacher judgment, which introduces an element of subjectivity. Employing multiple assessors or triangulating with digital recordings may enhance the objectivity of future evaluations. Lastly, the intervention used only one type of natural loose part leaves so the findings may not represent the potential impact of other natural or synthetic loose parts. Future studies could explore the effects of stones, twigs, bottle caps, seeds, or mixed-material loose parts, conduct longitudinal investigations to observe long-term effects, integrate digital or multisensory enhancements, or examine outcomes among children with special needs or developmental delays. These areas offer valuable opportunities for expanding the scope of loose parts research in early childhood education.

4) CONCLUSIONS

The findings of this Classroom Action Research confirm that loose-parts play using natural materials, particularly leaves, effectively enhances kindergarten children's fine motor development. Children's skills, initially underdeveloped with a pre-cycle mean of 34%, improved to 52% in Cycle I and reached 92% in Cycle II, with all children achieving the *Berkembang Sangat Baik* (BSB) category. These gains reflect the value of sensory-rich, open-ended activities in strengthening finger control, wrist stability, hand–eye coordination,

scissor skills, and spatial awareness. The variability of leaf materials encouraged repeated practice, creativity, and problem-solving, enabling children to develop essential manipulative abilities in developmentally appropriate ways.

The study also highlights the critical role of teacher scaffolding, as reflective adjustments between cycles made the intervention increasingly responsive and effective. Improvements were not limited to motor competence but extended to attention, independence, and creative expression. Overall, loose-parts play with natural materials emerges as an effective, low-cost, and sustainable pedagogical approach for early childhood education. The success of this intervention supports the broader integration of loose parts in Indonesian kindergarten settings to foster hands-on, exploratory, and child-centered learning experiences.

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