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Fine Motor Development Through Mosaic Activities in Children Aged 4–5 Years: A Descriptive Qualitative Study at Play Group

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Abstract

Fine motor development is a fundamental aspect of early childhood growth, providing the neuromuscular foundation for daily independence and academic readiness. This study describes and analyzes the fine motor development of children aged 4–5 years through structured mosaic activities at Katolik Santa Miriam Kamanasa Play Group, Malaka Regency, East Nusa Tenggara, Indonesia. Using a descriptive qualitative design, data were collected through participatory observation, semi-structured teacher interviews, and documentation of children's artwork over six weeks (March–April 2026). Participants comprised 21 children from Group A. Data were analyzed using the Miles and Huberman model, involving data reduction, data display, and conclusion drawing. Findings indicate observable improvements across four fine motor indicators: (1) finger dexterity and hand-eye coordination; (2) spatial arrangement of mosaic pieces into coherent patterns; (3) precision in applying adhesive and placing materials; and (4) independent completion of artwork. Children gradually shifted from full-palm grasping to a refined pincer grip when handling small origami paper pieces and crushed eggshells. Concentration, patience, and independent task completion also increased throughout the observation period. Although individual differences persisted, with some children requiring guidance when handling small materials, the overall developmental trajectory indicated that mosaic activities supported fine motor development in accordance with national early childhood education standards. The findings highlight the pedagogical value of affordable, locally available materials in rural early childhood settings and offer practical recommendations for educators and future researchers.

Keywords: fine motor skills, mosaic activities, early childhood education, hand-eye coordination, pincer grip.

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INTRODUCTION

Early childhood constitutes the most neurologically dynamic period in human development. Known in developmental psychology as the "golden age," this phase roughly spanning birth to age eight is characterized by an unparalleled acceleration in cognitive, linguistic, social-emotional, and physical-motor capacities (Papalia & Martorell, 2021; Santrock, 2011). The experiences, stimuli, and environments that children encounter during this critical window do not merely influence present functioning; they sculpt the neurological architecture that will underpin all future learning, behavior, and adaptive capacity (Shonkoff & Phillips, 2000). Among the developmental domains that receive significant scholarly and pedagogical attention, fine motor development occupies a position of particular importance.

Fine motor skills are broadly defined as the capacity to execute coordinated, controlled, and precise movements using the small muscle groups of the hands, fingers, and wrists, in conjunction with visual guidance (Beery et al., 2010; Case-Smith, 2002). These skills encompass a wide repertoire of manipulative actions grasping, pinching, threading, cutting, folding, drawing, and writing all of which are indispensable for academic preparedness and everyday independence. Empirical evidence consistently demonstrates that well-developed fine motor competencies in preschool are robust predictors of later academic achievement, particularly in reading and mathematics, as they facilitate the physical act of writing and the manipulation of learning tools (Cameron et al., 2012; Grissmer et al., 2010).

In Indonesia, the national standard for early childhood education as codified in Ministerial Regulation No. 137 of 2014 (Kemendikbud, 2014, Issue 137/2014) specifies that children aged 4-5 years (Group A) should be capable of coordinating hand-eye movements in complex tasks, manipulating objects through various media, expressing themselves through artistic works, and controlling hand movements through pinching and twisting skills. These standards establish a clear developmental benchmark and underscore the institutional commitment to holistic early childhood education in the Indonesian context. However, the translation of these standards into effective classroom practice remains uneven, particularly in resource-limited rural settings.

Preliminary observations conducted at Katolik Santa Miriam Kamanasa Play Group, situated in Kamanasa Village, Central Malaka Sub-district, Malaka Regency, East Nusa Tenggara, revealed a significant gap between the expected developmental milestones and the actual fine motor achievements of children in Group A. The majority of the 21 observed children demonstrated a tendency to use their whole hand or palm when attempting to grasp small objects, rather than employing the more refined pincer grip the coordinated use of the thumb and index finger that is developmentally appropriate for their age. Their hand-eye coordination was inconsistent; many struggled to place materials within designated boundary lines, and their concentration during manual tasks was frequently interrupted.

This developmental lag, if left unaddressed through structured, repeated, and pedagogically sound stimulation, poses a risk of cascading difficulties upon entry into primary schooling: struggles with pencil grip, letter formation, scissor use, and the general fine-motor demands of formal literacy and numeracy instruction (Dinehart & Manfra, 2013). The need for an evidence-based, contextually appropriate, and engaging intervention was therefore clearly identified.

Mosaic art the practice of creating two- or three-dimensional designs by arranging and adhering small fragments of material (tesserae) onto a prepared surface presents a theoretically and empirically compelling solution to this developmental challenge. The procedural demands of mosaic creation map directly onto the fine motor indicators specified in national standards: children must pick up small pieces (activating the pincer grip and distal finger control), apply adhesive (modulating pressure and hand stability), and place pieces accurately within pattern boundaries (exercising hand-eye coordination and spatial reasoning).

Multiple prior studies within the Indonesian early childhood education context have confirmed the efficacy of mosaic techniques in stimulating fine motor development. Halilah and Suzanti (2023) demonstrated that mosaic activities significantly optimized fine motor development and manipulative skills in early childhood through the repeated actions of picking up and adhering material pieces. Sukmawati et al. (2021) concluded, through a systematic literature review, that origami paper mosaic media effectively facilitated finger muscle flexibility in children aged 4-5 years. Rezieka et al. (2022) published findings in the Jurnal Obsesi confirming that functional finger training through mosaic activities constitutes a substantive strategy for fine motor improvement in early childhood. More recently, Nisak and Aulina (2024) demonstrated the effectiveness of mosaic using mussel shells as natural media, while Randani et al. (2024) and Jaya and Sartika (2023) corroborated these findings across geographically diverse Indonesian settings.

What distinguishes the present study from the existing literature is its specific attention to the contextual appropriateness of material selection. The use of origami paper and eggshells rather than commercially manufactured mosaic tiles or uniform paper cuts was a deliberate response to the geographic, economic, and cultural conditions of Kamanasa Village. Eggshells represent an abundantly available household waste material in the local community and at the MASF convent environment, obtainable at no cost. Origami paper, a widely recognized and affordable art material, provides the contrasting chromatic variety needed to make patterns visually clear to young children. This material selection thus demonstrates that high-quality fine motor stimulation can be achieved without reliance on expensive or externally sourced educational supplies, a finding of direct relevance to practitioners in rural NTT and similar resource-constrained settings across Indonesia.

The theoretical foundation of this study draws on Jean Piaget's constructivist theory of cognitive development, which posits that children learn most effectively through active, hands-on engagement with their environment (Piaget, 1952). The concrete, manipulative nature of mosaic activities aligns with the preoperational stage (ages 2-7), wherein children learn through direct sensory interaction with physical objects. Complementarily, Vygotsky's sociocultural theory (1978) provides the scaffolding framework: the role of the teacher in providing verbal guidance, modeling, and graduated assistance reflects the Zone of Proximal Development (ZPD), within which children achieve tasks they could not accomplish independently.

From a neurodevelopmental perspective, the repeated activation of small muscle groups in the hand and fingers through mosaic activities promotes synaptic consolidation and myelination of motor neural pathways processes that underlie the progressive refinement and automatization of fine motor skills (Diamond, 2000). The tactile, proprioceptive, and visual inputs generated during mosaic creation also

stimulate multisensory neural integration, further deepening the developmental impact of the activity.

This study pursues the following specific objectives: (1) to describe the process of fine motor development in children aged 4-5 years at Katolik Santa Miriam Kamanasa Play Group Malaka through mosaic activities using origami paper and eggshells; (2) to analyze observable changes in four key fine motor indicators finger dexterity, pattern arrangement, pasting precision, and independent artwork completion across the observation period; and (3) to discuss the pedagogical and practical implications of employing locally available, low-cost materials in early childhood fine motor stimulation in rural educational contexts.

METHOD

This study employed a descriptive qualitative research approach. Qualitative research is epistemologically suited to investigations that seek to understand phenomena in their natural settings through the direct experiences of participants, generating rich, contextualized narrative data rather than statistical generalizations (Creswell & Poth, 2018). The descriptive dimension of the design specifies the goal of systematically characterizing the fine motor development process as it naturally unfolded during mosaic activities, without experimental manipulation of variables. This design allows for nuanced, holistic documentation of developmental change, individual variation, and the pedagogical conditions that shaped children's learning (Rukminingsih, 2020).

The study was conducted at Katolik Santa Miriam Kamanasa Play Group, located on Biara MASF Kamanasa Street, Central Malaka Sub-district, Malaka Regency, East Nusa Tenggara Province, Indonesia. Geographically, the institution is embedded within a rural village community adjacent to the MASF (Missionarissen van de Allerheiligste Familie) convent, situated near the principal road connecting Kamanasa Village with the Central Malaka administrative center. Data collection was conducted over an active period of six weeks, from March 9 to April 20, 2026.

Research participants comprised the 21 children enrolled in Group A (ages 4-5 years) of Katolik Santa Miriam Kamanasa Play Group during the 2025/2026 academic year. All children participated in the regularly scheduled mosaic activities as part of the classroom curriculum; no additional experimental sessions were introduced. Key informant for interview data was the Group A classroom teacher (referred to by the pseudonym "AS" throughout this report), who provided pedagogical observations and professional assessments of children's developmental progress. Three complementary data collection methods were employed to ensure triangulation of evidence and enhance the trustworthiness of findings (Lincoln & Guba, 1985).

Participatory observation involved the researcher engaging directly in the classroom environment while systematically observing and recording children's behavior during mosaic activities (Sari, 2023). Observation focused on four fine motor indicators: (1) finger dexterity, pincer grip quality, concentration, and hand-eye coordination; (2) ability to arrange mosaic pieces into a complete pattern; (3) precision and neatness in pasting; and (4) capacity to independently produce a complete artwork. Observations were recorded on structured observation sheets, with additional field notes capturing qualitative nuance regarding individual

children's responses, teacher interventions, and the relational dynamics of the learning environment.

Semi-structured interviews were conducted with the classroom teacher (AS) at multiple points throughout the data collection period. Interview questions were designed to elicit professional observations regarding children's fine motor progress, pedagogical strategies employed, challenges encountered, and the teacher's overall assessment of the mosaic activities' developmental impact. Interviews were audio-recorded with consent and subsequently transcribed verbatim for analysis.

Children's completed mosaic artworks were systematically collected and analyzed as material artifacts reflecting fine motor outcomes at specific points in time. Photographs of artworks were taken before collection to document visual quality, pasting precision, pattern completion, and evidence of independent creative decision-making. Photographs of the activity process itself were also captured, documenting children's grip patterns, posture, and work strategies.

Data analysis followed the Miles and Huberman (1994) interactive model, comprising three concurrent analytical processes: data reduction, data presentation, and conclusion drawing/verification (Rijali, 2018; Saleh, 2017). Data reduction involved the systematic selection, summarization, and focusing of raw datao bservation records, interview transcripts, and documentation notes to identify the most pertinent information for understanding fine motor development across the four indicators. Irrelevant or redundant data were set aside, while patterns, anomalies, and significant episodes were coded and categorized.

Data presentation involved organizing the reduced data into coherent narrative descriptions for each fine motor indicator, supplemented by documentary evidence. The narrative format was chosen as most appropriate for communicating the qualitative, process-oriented nature of the findings (Saleh, 2017).

Conclusion drawing involved deriving interpretations from the presented data, with conclusions verified through return to the raw data and cross-checking against interview and documentary sources to ensure accuracy and credibility. Member checking with the classroom teacher was conducted to validate interpretive accuracy (Lincoln & Guba, 1985).

Trustworthiness was established through four criteria: credibility (via triangulation of observation, interview, and documentation data; extended time in the field; and member checking); transferability (through thick description of context enabling readers to assess applicability); dependability (through maintenance of an audit trail of field notes, interview transcripts, and analytical memos); and confirmability (through reflexive bracketing of researcher assumptions and alignment of conclusions with raw data) (Creswell & Poth, 2018; Lincoln & Guba, 1985).

RESULTS

Finger Dexterity, Concentration, and Hand-Eye Coordination

The first indicator examines the quality of children's finger movements when handling mosaic materials, the duration and stability of their concentration during the activity, and the precision of their hand-eye coordination in placing materials. At the commencement of mosaic activities in early March 2026, field observations revealed that the majority of Group A children exhibited characteristic patterns of

immature fine motor functioning. When tasked with picking up small pieces of origami paper cut to approximately one-centimeter squares, most children employed a whole-hand or palmar grasp using all fingers simultaneously or pressing the target piece against the palm rather than the developmentally expected pincer grip. This grasp pattern is consistent with Gesell's developmental norms, which identify the mature pincer grip as typically emerging and consolidating during the four-to-five year period but requiring active stimulation to refine (Beery et al., 2010). Concentration spans were short; many children became distracted after two to three minutes of sustained pasting, requiring frequent teacher redirection.

By the observation recorded on March 11, 2026 following several sessions of structured mosaic activity a visible and qualitatively meaningful shift in grasp patterns was documented. Children began demonstrating the voluntary use of the thumb and index finger to pick up paper pieces quickly and with directional control. The transition was not uniform across all children; some made this shift earlier, while others required additional repetitions. However, the trend was consistent and aligned with the principles of motor learning theory, which posits that skill acquisition follows a practice-frequency-dependent trajectory (Schmidt & Lee, 2011).

Classroom teacher AS confirmed in interview that the most striking change she observed was in children's concentration: "After participating regularly in mosaic activities, the children's concentration became much more stable. They appear calmer, pay closer attention when I give instructions, and can coordinate their visual focus with their hand movements in a harmonious way." This qualitative observation aligns with research by Kamala and Chandra (2021) and Primayana (2020), who identify sustained attention and visual-motor integration as co-developing outcomes of fine motor activity in early childhood.

Hand-eye coordination improvement was most evident in children who were able to complete their mosaics independently, neatly, and without misplacement of material. For a subset of children, while hand-eye coordination showed clear improvement trends, they continued to require motivational encouragement and brief teacher assistance when handling particularly small mosaic pieces. This differentiated response highlights the importance of recognizing and accommodating individual developmental variability within the group setting.

Spatial Arrangement: Composing Mosaic Pieces into a Complete Pattern

The second indicator assesses children's capacity to perceive a spatial pattern template and systematically fill it with mosaic pieces to create a recognizable, complete image a cognitive-motor competency requiring spatial reasoning, sequential planning, and sustained goal-directed effort.

This indicator was specifically assessed during the activity involving the arrangement of crushed eggshell pieces onto a pre-drawn chicken pattern. Eggshell, as a material, presented greater cognitive-motor demands than flat origami paper: its irregular, angular fracture lines created uniquely shaped pieces that did not conform to uniform templates, requiring children to visually assess piece shape, rotate or reposition pieces as needed, and judge their fit against the curved outlines of the chicken image. Field observations recorded on March 12, 2026, documented that the majority of children were able to examine the pattern carefully, identify the spatial boundaries of different body parts (head, body, wings, feet), select eggshell pieces of proportional size, and begin placing them systematically within the boundary lines.

The patience and perseverance displayed by the children during this activity was qualitatively notable. Unlike earlier sessions where attention drift was common, the tactile novelty and visual interest of the eggshell material appeared to sustain engagement over longer periods. Children could be observed carefully studying pieces before placing them, self-correcting misplacements by repositioning rather than abandoning the task, and persisting toward completion despite the difficulty of the material.

Teacher AS confirmed in interview that children demonstrated high enthusiasm and showed growing comprehension of spatial instructions including the conceptual distinction between the "inside" and "outside" of a drawn line. However, it was noted that two children (referred to by the pseudonyms Aura and Devin) initially experienced difficulty aligning eggshell fragments with the curved boundary lines of the pattern, producing arrangements that appeared uneven. With sustained verbal guidance and repeated demonstration from the teacher a pedagogical approach consistent with Vygotsky's (1978) ZPD scaffolding both children continued to make effortful attempts to complete the task, reflecting positive development of persistence and frustration tolerance even in the context of challenge.

Precision and Neatness in Pasting Activity

The third indicator evaluates the precision with which children applied adhesive and placed mosaic pieces within the designated pattern boundaries a parameter reflecting the maturity of their fine motor control and their developing understanding of functional tool use.

This indicator was assessed primarily through the artwork documentation of a bird pattern mosaic using origami paper pieces. Precision was operationally defined as: (a) the application of an appropriate quantity of adhesive (neither too little to adhere nor too much to cause soaking or tearing of the paper); and (b) the placement of origami pieces within the boundary lines of the bird pattern without significantly overlapping the boundary.

Early observations revealed that children frequently applied excessive amounts of adhesive, resulting in wet, wrinkled, or torn paper and an overall messy appearance. This overuse of adhesive reflects immature modulation of grip pressure and finger force a component of fine motor control that develops gradually through practice (Case-Smith & O'Brien, 2015). Over the observation period, a clear improvement trajectory was documented: children progressively applied smaller, more controlled quantities of adhesive, demonstrating growing understanding of the functional principle that "a little glue is enough."

Teacher AS articulated this developmental shift clearly in interview: "The children's independence in preparing their tools and materials, and their efficient use of glue, has developed very well. They are beginning to understand that glue only needs to be applied in a small amount so that the material doesn't get wet or tear, making their work cleaner and more aesthetically pleasing." Artwork documentation corroborated this observation: artworks produced in late March showed markedly higher neatness scores than those from early March, with origami pieces adhered more precisely along the contour lines of the bird image and fewer instances of material placed outside the designated boundaries.

A small number of children continued to paste slightly beyond the boundary lines in late-stage observations, but the frequency and magnitude of these inaccuracies had decreased substantially compared to baseline. This residual

variability is consistent with the literature on fine motor development, which acknowledges that precision gains follow a gradual, non-linear trajectory and that individual differences in developmental pace are normative (Beery et al., 2010).

Independent Production of Complete Artwork Using Mosaic Pieces

The fourth and final indicator evaluates the culminating output of the mosaic process: children's ability to independently conceive, execute, and complete a mosaic artwork from beginning to end, reflecting the integration of fine motor skill, creative agency, self-regulation, and task completion capacity.

This indicator was assessed through the final mosaic activity, in which children created a melon fruit image using crushed eggshell pieces. The melon pattern, with its broader, curvilinear form, presented a different spatial challenge from the chicken and bird patterns used in earlier sessions, requiring children to fill a larger surface area while maintaining consistent coverage without gaps. The independent nature of the task was emphasized: children were expected to retrieve their own materials, apply adhesive autonomously, select shell pieces based on their own visual judgments, and continue working without sustained teacher direction.

Documentation analysis of the completed artworks and final-stage observations produced several noteworthy findings. The majority of children successfully completed their artworks independently, without requiring sustained teacher assistance. Beyond the basic task of adhering pieces, children began to display elementary strategic and creative decision-making in their process for example, deliberately beginning pasting from the outer boundary line before filling the interior, a sequencing strategy that reflects spatial planning and procedural reasoning. The artworks of children who employed this strategy showed noticeably more uniform coverage and fewer gaps than those who pasted in a random order, suggesting that children were not merely executing motor actions but actively problem-solving and self-regulating their approach.

While some children still required brief teacher guidance for symmetrical and horizontal alignment of larger eggshell pieces, the successful completion of the artwork by all children even those who needed assistance represents a significant affirmation of the activity's developmental reach. The experience of completing an artwork independently was observed to produce visible emotional responses: children smiled, showed their work to peers, and expressed pride upon completion. These social-emotional outcomes enhanced self-efficacy, responsibility, discipline, and confidence align with the broader developmental goals of early childhood education in Indonesia and resonate with international research linking fine motor competency to positive academic self-concept (Grissmer et al., 2010).

DISCUSSION

Mosaic Activities as a Fine Motor Stimulation Strategy

The findings of this study confirm and extend the existing literature on mosaic activities as a fine motor development strategy in early childhood education. Across all four assessed indicators, children at Katolik Santa Miriam Kamanasa Play Group demonstrated meaningful, observable improvement over the six-week observation period. These results are consistent with the findings of Halilah and Suzanti (2023), Sukmawati et al. (2021), Rezieka et al. (2022), Rahim et al. (2020), Jaya and Sartika

(2023), and Ranti et al. (2023), collectively reinforcing the cross-contextual validity of mosaic activities as a fine motor intervention in Indonesian early childhood education.

The developmental mechanisms through which mosaic activities produce fine motor gains can be understood through multiple theoretical lenses. From a motor learning perspective (Schmidt & Lee, 2011), the repetitive, task-specific nature of mosaic activities provides the practice frequency and variability necessary for motor skill consolidation. Each session presents slightly different challenges different materials, patterns, sizes that encourage adaptive motor problem-solving rather than mere rote repetition. From a neurodevelopmental perspective (Diamond, 2000), the sustained activation of intrinsic hand muscles during fine manipulation promotes the experience-dependent synaptic strengthening and myelination that underlie increasingly precise and automatic motor control. From a constructivist perspective (Piaget, 1952), the hands-on, self-directed exploration of materials supports children's active construction of understanding about how objects behave, how tools work, and how fine adjustments in movement produce different outcomes.

The Role of Scaffolding and Individual Differences

A consistent finding across all four indicators was the presence of individual developmental variability. While the majority of children showed clear progress, a small subset required more sustained scaffolding particularly for tasks involving very small or irregularly shaped materials. This variability is developmentally normative and theoretically expected; Vygotsky's (1978) ZPD framework specifically anticipates that children will have different proximal zones at any given time, and that the teacher's role is to calibrate support to the individual child's current developmental edge rather than to apply uniform instruction.

The pedagogical approach of teacher AS combining verbal guidance, gestural demonstration, and positive encouragement while gradually withdrawing support as children internalized skills exemplifies effective ZPD-based scaffolding in an early childhood context. This finding has practical implications for teacher professional development: practitioners need not only understand the fine motor benefits of mosaic activities but also develop the observational skills to identify individual children's ZPDs and the pedagogical flexibility to provide differentiated support within a group setting.

Contextual Appropriateness of Material Selection

A distinctive contribution of this study lies in its documentation of the pedagogical and practical viability of using locally sourced, low-cost materials origami paper and eggshells in a rural, resource-constrained educational setting. The village of Kamanasa, with its predominantly agricultural community and limited access to commercially manufactured educational materials, represents a context that is characteristic of many rural areas across NTT and Indonesia more broadly. The finding that eggshells a byproduct of everyday household food preparation, available free of charge can serve as effective mosaic media with clear fine motor developmental benefits carries significant implications for

Concentration, Patience, and Self-Regulation as Co-Developing Outcomes

The findings revealed that fine motor improvement did not occur in isolation; it

was accompanied by and likely mutually reinforcing with improvements in concentration duration, patience, and self-regulatory capacity. Children educational equity and pedagogical resourcefulness.

This finding resonates with and extends the work of Nisak and Aulina (2024), who demonstrated the effectiveness of mussel shells in the coastal East Java context. Together, these studies suggest a broader principle: the ecological availability of natural materials in specific geographic contexts can and should inform the selection of educational media in early childhood programs, rather than assuming that commercially produced materials are necessary prerequisites for quality fine motor stimulation. This principle supports sustainable, culturally responsive, and economically accessible early childhood education practices. who showed the greatest fine motor gains also demonstrated the most marked improvements in sustained attention, frustration tolerance, and independent task completion. This pattern of co-development aligns with theoretical frameworks emphasizing the interrelationship between motor development and executive function in early childhood (Blair & Diamond, 2008; Diamond, 2000), and with empirical research suggesting that activities requiring sustained, precise manual engagement also train attentional self-regulation (Primayana, 2020).

These findings suggest that the developmental impact of mosaic activities extends beyond fine motor domains, offering a multifunctional learning experience that simultaneously nurtures cognitive, emotional, and behavioral competencies essential for school readiness. For practitioners, this broadened understanding of mosaic outcomes reinforces the activity's value within a holistic early childhood curriculum framework.

CONCLUSION

This descriptive qualitative study provides robust empirical evidence that structured mosaic activities, conducted using origami paper and eggshell media, effectively stimulate fine motor development in children aged 4-5 years at Katolik Santa Miriam Kamanasa Play Group, Malaka Regency, East Nusa Tenggara. Findings across four observed indicators finger dexterity and hand-eye coordination, spatial pattern arrangement, pasting precision, and independent artwork production consistently documented meaningful developmental progress over the six-week study period.

Children progressively transitioned from immature palmar grasps to refined pincer grips; their hand-eye coordination became more precise; their patience and concentration deepened; and their capacity for self-directed, independent task completion increased. These gains were achieved without access to commercially manufactured materials, demonstrating that high-quality fine motor stimulation is achievable through ecologically available, low-cost resources in rural educational settings. Individual developmental variability was accommodated through differentiated teacher scaffolding consistent with Vygotskian ZPD principles.

Overall, the mosaic activities implemented at Katolik Santa Miriam Kamanasa Play Group met the developmental targets specified in Permendikbud No. 137/2014, affirming the strategy's alignment with national early childhood education standards. The study thus contributes to the growing evidence base supporting mosaic technique as a variatif, innovative, and effective physical-motor learning strategy for early childhood education in Indonesia.

Based on the findings, the following recommendations are offered. For early childhood educators, it is recommended that mosaic activities be incorporated as a regular component of fine motor curriculum, with particular attention to the scaffolded introduction of varied materials that progressively increase in difficulty. Natural, locally available materials eggshells, seeds, dried leaves, gravel, or mussel shells should be considered as first-choice media, particularly in rural settings, to ensure both ecological responsiveness and economic sustainability.

For school administrators and curriculum developers, investment in educator professional development regarding the theoretical foundations of fine motor development and the pedagogical principles of ZPD-based scaffolding is recommended, to enhance the intentionality and effectiveness of fine motor stimulation activities across early childhood institutions.

For future researchers, this study recommends quantitative follow-up studies employing standardized fine motor assessment instruments such as the Beery-Buktenica Developmental Test of Visual-Motor Integration (VMI) or the Peabody Developmental Motor Scalesto provide objective, normative measurement of pre- and post-intervention fine motor performance. Comparative studies examining the relative efficacy of different mosaic materials, and longitudinal studies tracking the fine motor trajectories of children who participated in early mosaic stimulation into primary school, would further advance understanding in this domain.

Provide a conclusion to your study and final remarks on the value of your analysis, research, or paper. The limitations of your study should be addressed. Recommendations for future research related to your topic should also be mentioned.

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