

Improving Fine Motor Skills Through Natural Material Mosaic Activities for Children with Emotional Disorders

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Abstract: This study aimed to improve fine motor skills and emotional regulation among children with emotional difficulties through nature-based mosaic activities using an Activity-Based Learning approach at TK Negeri 1 Rantau Pulung, East Kutai Regency. The study employed Classroom Action Research conducted in two cycles, each consisting of planning, action, observation, and reflection. The participants were 10 children with emotional difficulties. Data were collected through structured observations assessing fine motor skills, concentration and attention, emotional responses, creativity and accuracy, independence, and emotional regulation. The findings demonstrated a substantial improvement in the overall achievement score, increasing from 26.25% (low category) at the pre-action stage to 53.50% (moderate category) in Cycle I and 80.75% (good category) in Cycle II, exceeding the predetermined success criterion of 75%. Improvements were also observed in fine motor skills (26.25%–80.25%), concentration and attention (26.00%–81.75%), emotional responses (26.25%–80.25%), and independence (26.50%–80.75%). These findings indicate that nature-based mosaic activities through Activity-Based Learning are effective in enhancing fine motor skills and supporting emotional regulation through meaningful, engaging, hands-on learning experiences appropriate to children's developmental needs.

Keywords: Activity-Based Learning, Children With Emotional Disturbances, Emotional Management, Fine Motor Skills, Natural Material Mosaic

Abstrak: Penelitian ini bertujuan meningkatkan kemampuan motorik halus dan pengelolaan emosi anak dengan hambatan emosional melalui kegiatan mozaik berbahan alam berbasis Activity-Based Learning di TK Negeri 1 Rantau Pulung, Kabupaten Kutai Timur. Penelitian menggunakan metode Penelitian Tindakan Kelas (PTK) dalam dua siklus yang meliputi perencanaan, tindakan, observasi, dan refleksi. Subjek penelitian berjumlah 10 anak dengan hambatan emosional. Data dikumpulkan melalui observasi terstruktur dengan aspek penilaian motorik halus, konsentrasi dan perhatian, respons emosional, kreativitas dan ketelitian, kemandirian, serta pengelolaan emosi. Hasil penelitian menunjukkan peningkatan rata-rata capaian dari 26,25% (kategori rendah) pada pra tindakan menjadi 53,50% (kategori sedang) pada Siklus I dan 80,75% (kategori baik) pada Siklus II, melampaui indikator keberhasilan sebesar 75%. Kemampuan motorik halus meningkat dari 26,25% menjadi 80,25%, konsentrasi dan perhatian dari 26,00% menjadi 81,75%, respons emosional dari 26,25% menjadi 80,25%, serta kemandirian dari 26,50% menjadi 80,75%. Temuan menunjukkan bahwa kegiatan mozaik berbahan alam berbasis Activity-Based Learning efektif meningkatkan motorik halus dan mendukung pengelolaan emosi melalui pengalaman belajar langsung, bermakna, menarik, dan sesuai perkembangan anak.

Kata Kunci: Activity-Based Learning, Anak Dengan Hambatan Emosional, Pengelolaan Emosi, Kemampuan Motorik Halus, Mozaik Berbahan Alam

INTRODUCTION

Fine motor skills constitute an important domain of early childhood development because they contribute to children's school readiness, participation in learning activities, and ability to perform everyday tasks. These skills involve coordinated control of the small muscles of the hands

and fingers together with visual-motor integration, enabling children to manipulate objects and perform classroom activities such as drawing, writing, cutting, pasting, and arranging materials. Recent evidence indicates that fine motor competence is closely associated with children's learning outcomes; a systematic review and meta-analysis found positive associations between fine motor skills and academic abilities, particularly mathematics and reading (Li et al., 2025). Fine motor development is also recognized as an important component of school readiness because preschool children spend a substantial proportion of classroom time engaged in activities requiring fine motor control, including writing, cutting, and manipulative play (Zhang et al., 2025). Longitudinal evidence further suggests that motor skills contribute to children's school-readiness profiles and are associated with subsequent academic and psychosocial outcomes (Kamphorst et al., 2022; Katagiri et al., 2021). Accordingly, providing developmentally appropriate opportunities to manipulate, arrange, grasp, pinch, and coordinate objects during early childhood is important for supporting children's fine motor development and their participation in learning and everyday activities.

Activity-Based Learning (ABL) was adopted as the instructional framework because it positions children as active participants who construct understanding through purposeful activities rather than merely receiving information from the teacher. ABL is characterized by the use of structured activities as the core of learning, active learner involvement, exploration, application of prior experience, teacher facilitation, and opportunities to process and reflect on learning experiences (Bonwell & Eison, 1991; Bajaj, 2021). In this study, ABL was operationalized through a sequence of orientation, exploration, active performance, guided problem solving, and reflection. During orientation, the teacher introduced the mosaic task, natural materials, and expected activity while connecting them with children's previous experiences. During exploration, children observed, touched, selected, and compared leaves, seeds, and twigs to become familiar with their shapes, sizes, and textures. In the active-performance stage, children independently grasped, pinched, arranged, and pasted the selected materials to construct mosaic patterns, making the activity itself the primary medium for developing fine motor coordination. When children encountered difficulties in arranging materials, maintaining attention, or managing frustration, the teacher provided prompts, demonstrations, and graduated assistance rather than immediately completing the task for them, thereby incorporating guided problem solving and maintaining children's active involvement. At the end of the activity, children were encouraged to observe their completed mosaics, communicate their experiences and feelings, and receive feedback and reinforcement from the teacher. This reflection stage is particularly important because ABL requires learners not only to perform an activity but also to process and reflect on the experience for learning to become meaningful. Thus, the natural material mosaic activity functioned not simply as a hands-on art task but as a structured ABL process integrating exploration, purposeful manipulation, problem solving, teacher scaffolding, and reflection to support fine motor skills, concentration and attention, emotional responses, and independence.

Previous research has provided empirical support for the role of fine motor and manipulative activities in children's development. Grissmer et al. (2010) demonstrated that early fine motor skills were associated with subsequent academic achievement, highlighting the importance of activities that provide opportunities for children to develop coordinated hand and finger movements. Cameron et al. (2012) further found that fine motor skills and executive function contributed to children's kindergarten achievement, suggesting that activities involving coordinated manipulation, sustained attention, and goal-directed behavior are relevant to school readiness. More recently, Li et al. (2025), through a systematic review and meta-analysis, confirmed a positive association between

children's fine motor skills and academic abilities, particularly mathematics and reading. In addition, Zhang et al. (2025) emphasized that preschool learning frequently involves fine motor demands, including drawing, writing, cutting, and object manipulation, reinforcing the importance of developmentally appropriate activities that provide repeated opportunities for fine motor practice. Collectively, these findings support the use of structured manipulative activities during early childhood; however, research specifically integrating natural material mosaic activities, Activity-Based Learning, fine motor development, and emotional regulation difficulties remains limited. This gap provides the rationale for the present study, which examines the descriptive developmental changes observed following the implementation of natural material mosaic activities within a Classroom Action Research context.

Although previous studies have established the developmental importance of fine motor activities and structured object manipulation in early childhood, existing evidence has predominantly focused on fine motor or academic outcomes in typically developing children, while mosaic and collage activities have generally been treated as art-based or manipulative activities rather than as systematically structured interventions integrating fine motor and emotional-behavioral development. Consequently, it remains unclear how natural material mosaic activities can be operationalized within an Activity-Based Learning framework to simultaneously address fine motor skills, concentration and attention, emotional responses, and independence. This issue is particularly relevant for children with emotional regulation difficulties because fine motor tasks requiring precision, sustained attention, persistence, and repeated attempts may elicit frustration, task avoidance, or dependence on teacher assistance, making their learning needs different from those of children without such difficulties.

Preliminary observations at TK Negeri 1 Rantau Pulung, East Kutai Regency, East Kalimantan, Indonesia, similarly identified difficulties among participating children in manipulating small objects, sustaining attention, responding appropriately to task-related frustration, and completing activities independently. The novelty of the present study therefore lies in implementing natural material mosaic activities as a structured Activity-Based Learning intervention for children with pedagogically identified emotional regulation difficulties, in which children progress through exploration, purposeful material manipulation, guided problem solving, and reflection using locally available natural resources. Rather than examining fine motor development as an isolated outcome, this study documents changes across four interrelated developmental aspects fine motor skills, concentration and attention, emotional responses, and independence through two cycles of Classroom Action Research. Accordingly, the study aimed to describe improvements in these four developmental aspects following the implementation of natural material mosaic activities based on Activity-Based Learning and to provide a contextually relevant instructional strategy for early childhood classrooms serving children with emotional regulation difficulties.

METHOD

This study employed a Classroom Action Research (CAR) design based on the cyclical action research model proposed by Kemmis and McTaggart (1988), which comprises four interconnected stages: planning, action, observation, and reflection. The research was conducted at TK Negeri 1 Rantau Pulung, East Kutai Regency, East Kalimantan, Indonesia, and was implemented in two action cycles, with each cycle consisting of three learning sessions. The classroom teacher acted as the practitioner who implemented the natural material mosaic activities, while the researcher served

as an observer responsible for monitoring the implementation and systematically recording children's developmental performance. Reflection was conducted collaboratively by the teacher and researcher at the end of each cycle to identify difficulties and determine improvements for the subsequent cycle. The participants were 10 children aged 4–5 years selected purposively based on pedagogical identification rather than clinical diagnosis. The inclusion criteria were children who consistently demonstrated difficulties in at least three relevant areas, including fine motor coordination (e.g., grasping, pinching, arranging, and pasting small objects), maintaining concentration and attention, regulating emotional responses when facing tasks or frustration, and completing activities independently. Identification was conducted through preliminary classroom observations using the four-aspect observation rubric, supported by teacher records and information from parents. Children who did not consistently demonstrate these characteristics, had incomplete baseline observations, or did not participate consistently during the intervention were excluded from the focused analysis. No professional clinical diagnosis of emotional disorder was required; therefore, the participants were categorized pedagogically as children with emotional regulation difficulties.

The intervention involved natural material mosaic activities based on Activity-Based Learning, emphasizing active participation, exploration, object manipulation, and hands-on learning experiences. Materials included leaves, seeds, small twigs, and other locally available natural objects. In each session, the teacher introduced the materials and activity objectives, demonstrated how to arrange and paste the materials, and guided children in completing individual mosaic tasks while gradually reducing assistance to promote independence. Safety and hygiene procedures were applied throughout the intervention. All natural materials were washed or cleaned, thoroughly dried, and inspected before use; sharp, thorny, moldy, contaminated, toxic, or easily fragmented materials were excluded. Materials were selected in sizes appropriate for children aged 4–5 years to minimize choking and ingestion risks, and parents were consulted regarding known allergies or sensitivities. Children washed their hands before and after the activities, were instructed not to place materials in their mouths, and remained under continuous adult supervision to prevent accidental ingestion, allergic reactions, scratches, or other injuries. Prior to the study, permission was obtained from the school, and the research procedures followed institutional ethical principles for research involving young children. Written informed consent was obtained from all 10 parents or legal guardians after they received information regarding the objectives, procedures, potential benefits, risks, confidentiality, and voluntary nature of participation. Age-appropriate verbal assent was obtained from each child, participation could be discontinued whenever a child showed discomfort or refused to continue, and children's identities were anonymized in all records and research reports.

Data were collected through structured classroom observations, semi-structured interviews, anecdotal records, and documentation. Structured observation served as the primary data collection technique using a developmental assessment rubric covering four aspects: fine motor skills, concentration and attention, emotional responses, and independence, with each indicator rated on a four-point scale: 1 = Not Yet Developed (NYD), 2 = Beginning to Develop (BD), 3 = Developing as Expected (DE), and 4 = Very Well Developed (VWD). Semi-structured interviews were conducted with one classroom teacher and the parents or guardians of the 10 participating children before and after the intervention, lasting approximately 15–20 minutes each, while anecdotal records and documentation, including photographs and children's mosaic products, were used to support observational findings. The four data sources were triangulated by comparing observation scores with interview responses, anecdotal records, and documentation, while qualitative data were

categorized according to the four developmental aspects and interpreted descriptively across the pre-intervention stage, Cycle I, and Cycle II. Quantitative data were analyzed descriptively at individual and group levels. Decimal scores reported in the results represent aggregated means rather than additional scale categories; each child's aspect score was calculated by dividing the total indicator scores by the number of indicators, while cycle scores were obtained by averaging scores across the three sessions. Achievement percentages were calculated using $P = (F/N) \times 100\%$, where P represents the achievement percentage, F the obtained score, and N the maximum possible score. The expected developmental level was defined as a mean score of ≥ 3.00 (Developing as Expected), equivalent to $\geq 75\%$ of the maximum score, and the intervention was considered successful when at least 75% of the participants, or a minimum of 8 of the 10 children, reached this threshold. As no inferential statistical tests were performed, changes across stages were interpreted as descriptive improvements rather than statistically significant differences.

RESULT AND DISCUSSION

The study was conducted at TK Negeri 1 Rantau Pulung, East Kutai Regency, East Kalimantan, Indonesia, an early childhood education institution that implements child-centered learning. The research involved 10 children aged 4–5 years in Group A who were identified as having difficulties in fine motor skills and emotional regulation based on preliminary classroom observations, teacher records, and information from parents or guardians. The participants demonstrated difficulties across the four developmental aspects assessed in this study: fine motor skills, concentration and attention, emotional responses, and independence. In terms of fine motor skills, several children experienced difficulty grasping, pinching, arranging, and pasting small objects and showed limited hand–eye coordination. They also had difficulty sustaining concentration and attention during learning activities, displayed emotional responses such as frustration or reluctance when encountering challenging tasks, and frequently required teacher assistance to complete activities independently. Although the classroom environment was conducive and supported by adequate learning facilities, preliminary observations indicated that the 10 children required more engaging and concrete learning experiences accompanied by appropriate teacher guidance. Therefore, natural material mosaic activities based on the Activity-Based Learning approach were implemented as an intervention to provide meaningful hands-on learning experiences aimed primarily at improving fine motor skills while simultaneously supporting concentration and attention, positive emotional responses, and independence.

Pre-Intervention

The pre-intervention stage was conducted to obtain baseline data on the children's fine motor skills and emotional regulation before the implementation of the natural material mosaic activities based on the Activity-Based Learning approach. Baseline data were collected through classroom observations, interviews with teachers and parents, anecdotal records, and documentation during regular learning activities. These findings served as the basis for designing the intervention implemented in Cycle I. The initial observation revealed that the children's performance across all observed aspects remained in the Not Yet Developed (NYD) category, with an overall average achievement of 26.25%. Fine motor skills reached an average score of 26.25%, indicating that most children experienced difficulties in grasping, pinching, and accurately pasting materials, while hand–eye coordination had not yet developed optimally. The concentration and attention aspect achieved an average of 26.00%, showing that the children had difficulty maintaining attention

throughout learning activities and frequently failed to complete tasks according to instructions. Emotional responses averaged 26.25%, suggesting that the children were easily frustrated, lacked persistence, and required continuous encouragement from the teacher when encountering difficulties. Meanwhile, the independence aspect obtained an average score of 26.50%, indicating that most children still relied heavily on teacher assistance to complete learning activities.

These findings were further supported by interviews with the classroom teacher and the children's parents. The teacher reported that the children experienced difficulties in performing fine motor tasks, had limited attention spans, easily gave up when confronted with challenging activities, and required intensive guidance throughout the learning process. Similarly, parents explained that their children had received limited fine motor stimulation at home and frequently displayed emotional reactions such as crying, becoming angry, or refusing to continue activities when facing difficulties. The consistency between the teacher's and parents' responses indicates that the children's difficulties in fine motor performance and emotional regulation occurred in both school and home environments. The anecdotal records also demonstrated that most children were easily distracted, lacked confidence, experienced difficulty manipulating and attaching mosaic materials, and tended to discontinue activities when they encountered obstacles. Although some children resumed the activities after receiving guidance from the teacher, they continued to require substantial assistance to complete the assigned tasks. Documentation further showed that the children's mosaic products were generally untidy, the placement of materials often did not follow the intended patterns, and overall participation in learning activities remained relatively low. These findings indicate that the children's fine motor skills, concentration, independence, and emotional regulation required more intensive instructional support.

Overall, the pre-intervention findings indicate that the children's fine motor skills and emotional regulation were still at a low developmental level and had not met the predetermined success criteria. Therefore, an instructional intervention that was engaging, activity-oriented, and developmentally appropriate was required. Natural material mosaic activities based on the Activity-Based Learning approach were selected as the intervention because they were expected to enhance fine motor coordination while simultaneously improving concentration, independence, and emotional regulation throughout the learning process.

Cycle I

Cycle I was implemented as the initial intervention to address the problems identified during the pre-intervention stage, particularly the children's limited fine motor skills and emotional regulation. The instructional activities were designed using the principles of Activity-Based Learning (ABL), emphasizing active participation through natural material mosaic activities. Before the intervention, lesson plans, learning materials, natural resources such as dried leaves and seeds, mosaic templates, adhesive, and assessment instruments were prepared. Observation sheets covering fine motor skills, concentration and attention, emotional responses, and independence were also developed to monitor children's progress throughout the learning process. The implementation of Cycle I began with introductory activities in which the teacher greeted the children, introduced the learning objectives, and demonstrated how to create a mosaic using natural materials. During the main learning activities, the children were encouraged to grasp, pinch, and paste natural materials onto prepared patterns individually or in small groups. Throughout the session, the teacher provided continuous guidance, demonstrations, encouragement, and emotional support, particularly for children who experienced difficulties or showed signs of frustration. At the

end of the lesson, the children reflected on their work, presented their mosaics, and received positive reinforcement from the teacher to strengthen their confidence and motivation.

During the learning process, the children demonstrated gradual improvements compared with the pre-intervention stage. Initially, several children appeared hesitant and lacked confidence in starting the activity. However, after receiving demonstrations and individual guidance, they began to manipulate the natural materials more independently. Most children were able to grasp, pinch, and paste the materials, although the accuracy of placement and hand–eye coordination had not yet reached the expected level. Some children still became distracted during the activity, while others required repeated reminders to maintain attention and complete their tasks. Nevertheless, classroom participation was noticeably higher than during the baseline observation.

Positive changes were also observed in the children's emotional responses and independence. Compared with the pre-intervention condition, the children demonstrated greater willingness to continue working when encountering difficulties and were less likely to abandon the activity immediately. Although some children still showed signs of frustration, teacher encouragement enabled them to resume and complete their tasks. Similarly, the children began to perform several learning activities independently, despite still requiring assistance during more challenging stages of the mosaic activity. These findings suggest that the natural material mosaic activities provided meaningful opportunities for children to practice fine motor coordination while simultaneously strengthening persistence, emotional regulation, and self-confidence. The implementation of Cycle I demonstrated encouraging initial progress across all observed developmental aspects. The children became more actively involved in the learning activities and showed improvements in fine motor performance, concentration, emotional regulation, and independence compared with the pre-intervention stage. However, the observed outcomes had not yet achieved the predetermined success criterion, indicating that further refinement of the instructional strategies was necessary. Consequently, the reflection findings from Cycle I served as the basis for improving the intervention in Cycle II to maximize children's developmental outcomes.

Table 1. Observation Results of Cycle I

No	Observed Aspect	Indicators	SL	SH	AB	RF	KV	SY	KN	AS	NS	DV
1	Fine Motor Skills	Accurately grasping materials; pinching and pasting materials correctly; demonstrating hand–eye coordination while arranging mosaic patterns	2.5	2.0	2.0	2.5	2.0	2.0	2.5	2.0	2.0	2.0
2	Concentration and Attention	Maintaining attention during activities; completing tasks according to instructions	2.5	2.0	2.0	2.5	2.0	2.0	2.0	2.5	2.0	2.0
3	Emotional Responses	Demonstrating enthusiasm; managing	2.5	2.0	2.0	2.0	2.0	2.5	2.0	2.0	2.0	1.9

		frustration when encountering difficulties; showing willingness to try again										
4	Independence	Completing tasks with minimal teacher assistance; making independent decisions when arranging materials	2.8	2.0	2.5	2.0	2.5	2.0	2.0	2.0	2.0	1.9
Average Score per Child			10.3	8.0	8.5	9.0	8.5	8.5	8.5	8.5	8.0	7.8
Percentage (%)			64.4	50.0	53.1	56.3	53.1	53.1	53.1	53.1	50.0	49.0

Developmental achievement was classified into four categories based on equal intervals of the four-point observation scale: 25.00–43.75% = Not Yet Developed (NYD), >43.75–62.50% = Beginning to Develop (BD), >62.50–81.25% = Developing as Expected (DE), and >81.25–100% = Very Well Developed (VWD), while $\geq 75\%$ was established separately as the individual success criterion. As shown in Table 1, Cycle I indicated a general shift from the low pre-intervention performance toward the Beginning to Develop (BD) category across the four assessed aspects. The improvement was relatively consistent among fine motor skills, concentration and attention, emotional responses, and independence, although emotional responses remained comparatively challenging for several children when they encountered difficulties during the mosaic tasks. At the individual level, performance varied, with only SL entering the DE category and none of the 10 children reaching the $\geq 75\%$ individual success threshold. Observational and supporting qualitative data indicated that children had begun to engage more actively in manipulating natural materials and sustaining attention, but several still required teacher prompts and assistance, particularly when managing frustration and completing tasks independently. These patterns informed the refinement of Cycle II, which emphasized clearer demonstrations, more gradual teacher assistance, repeated opportunities for material manipulation, and greater encouragement for children to complete mosaic tasks independently.

The interview findings supported the observational data. The classroom teacher reported that the children became more willing to participate in learning activities, demonstrated better emotional control, and gradually improved their concentration and fine motor performance. Parents also observed positive changes at home, where the children began engaging in simple fine motor activities such as drawing and manipulating small objects. In addition, several parents reported that their children became more confident and were more willing to complete tasks independently, although they still required occasional assistance when facing challenging activities. The anecdotal records further revealed positive behavioral changes throughout Cycle I. Most children showed greater interest in the mosaic activities, paid closer attention to the teacher's instructions, and demonstrated improved hand–eye coordination while grasping and attaching natural materials. Although several children continued to experience difficulties in placing small materials accurately, they were more persistent and generally resumed the task after receiving encouragement from the teacher instead of immediately giving up. Furthermore, positive reinforcement provided by the teacher increased the children's confidence and motivation to complete their work. Documentation

also showed that the children's mosaic products were more organized than those produced during the pre-intervention stage, although improvements in accuracy and neatness were still needed.

Despite these encouraging outcomes, the Cycle I results indicated that the intervention had not yet fully achieved the expected level of development. Several children remained easily distracted, required frequent teacher guidance, and had not consistently demonstrated independent task completion or stable emotional regulation. Reflection on Cycle I therefore highlighted the need to strengthen instructional strategies in the subsequent cycle by providing clearer demonstrations, increasing the variety of natural materials, implementing more individualized guidance, enhancing positive reinforcement, and creating a more supportive classroom environment. These improvements were expected to maximize children's fine motor development and emotional regulation in Cycle II.

Cycle II

Cycle II was designed to address the limitations identified in Cycle I while strengthening the positive outcomes already achieved. Improvements focused on providing clearer demonstrations, increasing the variety of natural materials, offering more individualized guidance, and delivering consistent positive reinforcement throughout the learning process. The learning activities continued to adopt the Activity-Based Learning (ABL) approach, enabling children to actively explore, manipulate, and arrange natural materials while developing fine motor skills and emotional regulation. Observation instruments covering fine motor skills, concentration and attention, emotional responses, and independence were prepared to evaluate children's progress throughout the intervention. The implementation of Cycle II followed four stages: introduction, demonstration, hands-on activities, and reflection. At the beginning of the lesson, the teacher reviewed the children's previous experiences with mosaic activities and introduced additional natural materials, including dried leaves, seeds, twigs, flowers, and small wooden pieces. The teacher then demonstrated the correct techniques for grasping, pinching, arranging, and pasting the materials while emphasizing accuracy, hand-eye coordination, and persistence. During the main activity, children created mosaic artworks individually or in small groups with gradual teacher guidance according to their individual needs. The lesson concluded with reflection, during which children shared their experiences and received appreciation for their efforts and completed work.

Compared with Cycle I, the children demonstrated greater confidence and participation throughout the learning activities. Most children were able to begin the tasks independently, follow the teacher's instructions more accurately, and remain engaged for longer periods. Their ability to grasp, pinch, and paste natural materials also became more precise, resulting in neater mosaic products and better hand-eye coordination. Although a few children still required occasional assistance, their dependence on teacher support gradually decreased as they became more familiar with the learning procedures. Improvements were also evident in the children's emotional regulation and independence. The children showed greater persistence when encountering difficulties and were more willing to repeat tasks without becoming easily frustrated. They demonstrated increased patience, confidence, and responsibility while completing the mosaic activities and interacted more positively with both teachers and peers. Furthermore, most children successfully completed their assignments independently, indicating that the Activity-Based Learning approach had fostered not only fine motor development but also emotional resilience and self-confidence during classroom activities.

Table 2. Observation Results of Cycle II

No.	Observed Aspect	Indicators	SL	SH	AB	RF	KV	SY	KN	AS	NS	DV
1	Fine Motor Skills	Accurately grasping materials; pinching and pasting materials correctly; demonstrating hand–eye coordination while arranging mosaic patterns	3.8	3.3	3.1	3.5	3.0	3.0	3.5	3.0	3.0	2.9
2	Concentration and Attention	Maintaining attention during activities; completing tasks according to instructions	3.9	3.4	3.0	3.7	3.2	3.0	3.0	3.5	3.0	3.0
3	Emotional Responses	Demonstrating enthusiasm; managing frustration when encountering difficulties; showing willingness to try again	3.8	3.4	3.0	3.5	3.0	3.5	3.0	3.0	3.0	2.9
4	Independence	Completing tasks with minimal teacher assistance; making independent decisions when arranging materials	3.8	3.2	3.5	3.0	3.5	3.0	3.4	3.0	3.0	2.9
Average Score per Child			15.3	13.3	12.6	13.7	12.7	12.5	12.9	12.5	12.0	12.0
Percentage (%)			95.6	83.1	78.8	85.6	79.4	78.1	80.6	78.1	75.0	73.0

The implementation of Cycle II was followed by substantial descriptive improvements across all observed developmental aspects. As presented in Table 2, the overall average achievement increased to 80.75%, exceeding the predetermined success criterion of 75% and falling within the Developing as Expected (DE) category (>62.50–81.25%), rather than the Very Well Developed (VWD) category. Compared with Cycle I, fine motor skills increased to 80.25%, indicating improved accuracy in grasping, pinching, arranging, and pasting natural materials as well as better hand–eye coordination. Concentration and attention reached the highest average achievement at 81.75%, which entered the Very Well Developed (VWD) category (>81.25–100%), reflecting greater ability to maintain attention and complete activities according to instructions. Emotional responses increased to 80.25%, accompanied by greater enthusiasm, improved management of frustration, and stronger persistence when encountering task difficulties, while independence reached 80.75%, indicating reduced reliance on teacher assistance during mosaic activities. Overall, these findings show that improvements in fine motor skills, concentration and attention, emotional

responses, and independence were observed following the implementation of natural material mosaic activities based on Activity-Based Learning within this classroom context. However, given the Classroom Action Research design involving a single group without a comparison or control group, these findings should be interpreted as descriptive improvements associated with the intervention rather than evidence of a definitive causal effect or generalizable effectiveness.

Individual performance also showed considerable descriptive improvement in Cycle II. SL achieved the highest score (95.6%), followed by RF (85.6%), SH (83.1%), and KN (80.6%), indicating strong performance across the assessed developmental aspects. KV (79.4%), AB (78.8%), SY (78.1%), and AS (78.1%) also demonstrated improved developmental performance, although occasional teacher guidance was still required. NS achieved 75.0%, reaching the predetermined individual success threshold of $\geq 75\%$, whereas DV obtained 73.1%, based on a total score of 11.7 out of a maximum score of 16, and therefore remained slightly below the individual success threshold. Accordingly, 9 of the 10 children (90%) reached the predetermined individual success criterion in Cycle II, exceeding the study criterion that at least 75% of participants, or a minimum of 8 children, should achieve the expected level. Nevertheless, DV also demonstrated descriptive improvement compared with Cycle I, particularly in task engagement and emotional responses. Interview findings with the classroom teacher and parents or guardians were generally consistent with the observational results, indicating improvements in children's fine motor coordination, concentration and attention, independence, and emotional responses both during classroom activities and, according to parents, in related activities at home. These converging findings support the interpretation that positive developmental changes were observed following the intervention, although the findings should remain limited to the context of this classroom action research.

Evidence from the anecdotal records and classroom documentation reinforced these findings. During Cycle II, the children participated more actively, followed instructions more consistently, and demonstrated greater confidence in completing mosaic tasks independently. Their mosaic products were noticeably neater and more accurately arranged than those produced during Cycle I. Furthermore, the children displayed higher levels of persistence, patience, and self-confidence when presenting their completed work. The consistent improvements observed across multiple sources of evidence indicate that the natural material mosaic activities based on the Activity-Based Learning approach successfully promoted fine motor development while simultaneously enhancing emotional regulation, concentration, and independence among children with emotional disturbances.

Overall Research Results

The overall findings demonstrate a consistent improvement in the children's development from the pre-intervention stage through Cycle I and Cycle II. During the pre-intervention stage, the children's average achievement remained low, indicating limited fine motor skills, concentration, emotional regulation, and independence. Following the implementation of natural material mosaic activities based on the Activity-Based Learning approach, an initial improvement was observed in Cycle I, with the overall average increasing to 53.50%, indicating that the children had begun to develop the targeted skills. More substantial progress was achieved in Cycle II, where the overall average reached 80.75%, exceeding the predetermined success criterion of 75%. Improvements were consistently observed across all assessed aspects, including fine motor skills, concentration and attention, emotional responses, and independence. These findings indicate that the intervention

effectively promoted children's holistic development by enhancing fine motor coordination while simultaneously improving emotional regulation, attention, and independent task completion.

Table 3. Summary of Research Findings

No.	Observed Aspect	Pre-Intervention (%)	Cycle I (%)	Cycle II (%)	Remarks
1	Fine Motor Skills	26.25	53.75	80.25	Descriptive improvement
2	Concentration and Attention	26.00	53.75	81.75	Descriptive improvement
3	Emotional Responses	26.25	52.25	80.25	Descriptive improvement
4	Independence	26.50	54.25	80.75	Descriptive improvement
Overall Average		26.25	53.50	80.75	Successful ($\geq 75\%$)

Across the intervention stages, a coherent pattern of improvement emerged across the four developmental aspects, suggesting that progress in fine motor performance occurred alongside changes in concentration and attention, emotional responses, and independence. As children became more familiar with selecting, grasping, arranging, and pasting natural materials, they also appeared increasingly able to remain engaged with the task, persist when encountering difficulties, and complete activities with less teacher assistance. Nevertheless, the rate of progress varied among participants, indicating that children responded differently to the same learning experiences and that some continued to require individualized guidance, particularly in managing task-related frustration and maintaining independent participation. By Cycle II, most participants had reached the predetermined individual success threshold, indicating that the intervention objectives were achieved at the classroom level. Taken together, these findings suggest that natural material mosaic activities structured through Activity-Based Learning provided a supportive learning context in which fine motor practice was integrated with opportunities to develop sustained engagement, more adaptive emotional responses, and greater independence. Given the single-group Classroom Action Research design, however, these changes should be interpreted as developmental improvements observed during and following the intervention rather than as evidence of a definitive causal effect.

Discussion

The findings indicate a consistent descriptive improvement across the four developmental aspects assessed during the two intervention cycles: fine motor skills, concentration and attention, emotional responses, and independence. The overall achievement progressed from the pre-intervention stage through Cycle I and Cycle II, with most children eventually reaching the predetermined individual success criterion. Rather than demonstrating a definitive causal effect, these findings indicate that positive developmental changes were observed during and following the implementation of natural material mosaic activities structured through Activity-Based Learning (ABL). This interpretation is consistent with empirical evidence showing the developmental relevance of fine motor experiences in early childhood. Cameron et al. (2012), for example, found that fine motor skills and executive function independently contributed to children's kindergarten achievement, while a recent systematic review and meta-analysis by Li et al. (2025) confirmed positive associations between fine motor competence and children's academic abilities. These studies reinforce the importance of providing young children with structured opportunities to coordinate visual information with controlled hand and finger movements.

The improvement observed in fine motor performance may be interpreted in relation to the repeated manipulative demands embedded in the mosaic activities. Children were required to grasp,

pinch, select, arrange, and paste leaves, seeds, and twigs across successive learning sessions, thereby repeatedly engaging hand–eye coordination and controlled finger movements. From a developmental perspective, this pattern is compatible with the principle that young children construct knowledge through active interaction with concrete experiences. More importantly, contemporary empirical evidence supports the relevance of fine motor and visual-motor abilities to children's broader learning development; Li et al. (2025) found positive relationships between fine motor skills and academic abilities, with visual-motor integration showing a particularly strong association with mathematical performance. Nevertheless, the present study cannot determine whether the observed fine motor improvement resulted specifically from the use of natural materials. Repeated practice, increasing familiarity with the tasks, teacher demonstrations, scaffolding, and modifications introduced between action cycles may also have contributed to the observed changes. Therefore, the natural materials should be understood as one component of the broader ABL learning process rather than as an independently established causal mechanism.

A similar pattern was observed in concentration and attention. The mosaic activities required children to select materials, follow sequential instructions, organize objects according to a pattern, and sustain engagement until the task was completed. These demands combined fine motor coordination with goal-directed attention, suggesting that the developmental aspects assessed in this study were interconnected during task performance rather than functioning independently. This interpretation is consistent with Cameron et al. (2012), who reported that fine motor skills and executive function represent distinct but complementary contributors to children's early learning achievement. Within the present intervention, teacher demonstrations, verbal prompts, encouragement, and gradually reduced assistance may have helped children remain engaged with tasks that initially elicited distraction or avoidance. However, because teacher scaffolding, task repetition, concrete materials, and increasing familiarity occurred simultaneously, the present Classroom Action Research design does not allow their individual contributions to be isolated.

Changes in emotional responses and independence provide an additional dimension to the findings. Across the cycles, children increasingly demonstrated willingness to continue mosaic tasks after encountering difficulties, required less teacher assistance, and showed more adaptive responses to task-related frustration. These behavioral changes can be interpreted in relation to the opportunities provided for children to make choices, attempt tasks independently, experience manageable challenges, and receive supportive feedback. Erikson's psychosocial perspective is relevant as an interpretive framework because children in the preschool period are developing initiative through opportunities to act, choose, and pursue purposeful activities (Erikson, 1963). In the context of this study, the emotional-response indicator did not measure clinical emotional regulation; rather, it captured observable classroom behaviors such as enthusiasm, responses to frustration, and willingness to try again. Accordingly, the findings should be interpreted as improvements in observable task-related emotional responses, not as evidence of changes in clinically assessed emotional functioning. Similarly, greater independence reflected children's reduced need for assistance when completing mosaic activities rather than a generalized change in independence across all settings.

Taken together, the findings extend previous research by showing how fine motor practice can be embedded within a structured ABL sequence that simultaneously creates opportunities for sustained attention, adaptive task-related emotional responses, and independent participation among children with pedagogically identified emotional regulation difficulties. The contribution of this study therefore lies not in demonstrating that natural materials alone produce developmental gains,

Mayasari et al. (Improving Fine Motor Skills Through Natural...)

but in documenting how exploration, purposeful manipulation, guided problem solving, repeated practice, teacher scaffolding, and reflection can be integrated into natural material mosaic activities within an authentic early childhood classroom. The convergence of structured observation, teacher and parent interviews, anecdotal records, and children's work further supported the pattern of developmental change observed across the cycles. Nevertheless, because the study involved only 10 children in one classroom, lacked a comparison group, and implemented several intervention components simultaneously, the findings should remain context-specific. Future studies using larger samples, comparison groups, standardized measures, and component-specific designs are needed to determine whether the observed changes can be attributed specifically to natural material mosaic activities, the ABL framework, teacher scaffolding, repeated practice, or interactions among these components.

CONCLUSION

This study showed descriptive improvements in fine motor skills, concentration and attention, emotional responses, and independence among children with emotional regulation difficulties following the implementation of natural material mosaic activities based on Activity-Based Learning (ABL) at TK Negeri 1 Rantau Pulung, East Kutai Regency, East Kalimantan, Indonesia. Across the intervention stages, the overall average achievement increased from 26.25% at the pre-intervention stage to 53.50% in Cycle I and 80.75% in Cycle II, exceeding the predetermined group success criterion of 75%. At the individual level, 9 of the 10 children (90%) reached the predetermined achievement threshold of $\geq 75\%$ by Cycle II. These findings indicate that structured mosaic activities involving exploration, manipulation of natural materials, guided problem solving, repeated practice, and gradually reduced teacher assistance provided a supportive learning context in which improvements in fine motor performance occurred alongside positive changes in concentration and attention, task-related emotional responses, and independence. Several limitations should be considered when interpreting these findings. The study employed Classroom Action Research within a single classroom and involved a small sample of only 10 children without a comparison or control group; therefore, the observed improvements cannot be attributed exclusively to the intervention. Other factors, including repeated practice, increasing familiarity with the activities, teacher guidance, and modifications introduced between cycles, may have contributed to the observed changes. In addition, the involvement of the teacher and researcher in implementing and observing the intervention may have introduced observer or expectancy bias. The use of observational rating scales also involves subjective judgment despite the application of predetermined indicators and supporting data triangulation. Furthermore, the participants were identified pedagogically as experiencing emotional regulation difficulties rather than through professional clinical diagnosis. Consequently, the findings are context-specific and should not be generalized to all children with emotional or developmental difficulties.

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