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Optimizing Early Childhood Sensorimotor Development through Nature-Based Art Activities: A Case Study at Tarbiyatul Islamiyah Playgroup

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ABSTRACT

This study aims to describe the implementation of nature-based art activities and identify the supporting and inhibiting factors in optimizing the sensorimotor development of early childhood at Tarbiyatul Islamiyah Playgroup. This study employed a qualitative descriptive approach using a case study design. The research participants consisted of 20 playgroup children aged 3–4 years and their classroom teacher. Data were collected through participatory observation, in-depth interviews, and documentation of the children's work. The data were analyzed qualitatively using the interactive model of data reduction, data display, and conclusion drawing. The findings revealed that nature-based art activities, including threading papaya leaf stalks, modeling with clay, and creating collages from seeds, effectively stimulated hand–eye coordination, fine motor strength, sensory sensitivity, concentration, and children's independence. Supporting factors included the availability of natural materials within the school environment, teachers' creativity, children's enthusiasm,

and parental support. Meanwhile, the inhibiting factors comprised limited instructional time, differences in children's motor abilities, inadequate facilities, and limited teacher training related to nature-based art activities. The findings confirm that nature-based art activities constitute an innovative and contextual learning strategy that effectively supports the optimization of sensorimotor development in early childhood education.

Introduction

Early Childhood Education (ECE) plays a crucial role in shaping the quality of future human resources, as it represents the **golden age**, a critical period that determines children's developmental success in subsequent stages of life (Mulyasa, 2017). During this period, children experience rapid growth and development, making it essential to optimize all developmental domains to foster independent, creative, and morally responsible individuals. The success or failure of developing children's potential largely depends on the awareness of parents and educators in making the most of this golden period. Therefore, ECE institutions should design holistic and integrated learning experiences, one of which emphasizes the development of children's sensorimotor abilities.

Sensorimotor development refers to the integration of sensory and motor abilities, which forms the foundation for young children's cognitive, social, and emotional development (Suyadi & Ulfah, 2015). These components provide an essential basis for children's overall

growth and learning readiness. Motor development consists of two primary domains: fine motor skills, which involve the coordination of small muscles to perform activities such as grasping, writing, and manipulating objects, and gross motor skills, which engage large muscle groups for activities such as walking, running, and jumping (Dadan, 2016). These two domains complement one another and serve as fundamental prerequisites for children's readiness to participate in formal learning activities.

According to Piaget, the sensorimotor stage (0–2 years) represents the earliest phase of cognitive development, during which intelligence is constructed through children's direct interactions with their environment (McLeod, 2025). Although this stage formally occurs during infancy, its underlying principles remain relevant throughout early childhood because children continue to refine the coordination between sensory perception and motor actions until approximately six years of age (Marinda, 2020). Meanwhile, Vygotsky emphasized the importance of social interaction, adult guidance, and the use of appropriate educational media in facilitating children's development (Daniels, 2016). Consequently, learning activities that integrate sensory stimulation with motor experiences play a vital role in fostering young children's foundational competencies. Sensory stimulation through activities involving diverse textures has also been shown to strengthen children's sensorimotor coordination (Aydos, 2025).

Consistent with the importance of integrating sensory stimulation

and motor activities in early childhood, the learning process should provide opportunities for children to actively explore their environment through direct interaction with concrete objects. Exploration-based learning enables children to develop hand–eye coordination, concentration, and independence through active engagement in authentic experiences (Lillard, 2017). Furthermore, experiential learning theory emphasizes that learning becomes meaningful when children actively participate in the learning process through learning by doing, whereby concrete experiences serve as the primary source for constructing knowledge and developing skills (Kolb, 2015). Therefore, nature-based art activities that encourage children to observe, touch, and manipulate real materials from their surrounding environment constitute a relevant approach for fostering creativity while simultaneously optimizing children's sensorimotor development.

Nature-based art activities represent an educational approach that utilizes materials obtained from the surrounding environment as learning media (Sari, 2022). These activities also employ natural resources to stimulate various aspects of early childhood development (Hardiyanti, 2025). Materials such as stones, twigs, leaves, seeds, and plant stalks are not only readily available but also capable of stimulating multiple developmental domains. Through activities such as drawing, pasting, painting, and creating collages using natural materials, children are able to express themselves while simultaneously developing hand–eye coordination, fine motor strength, sensory

sensitivity, and concentration. This approach is closely aligned with the principles of contextual learning, which emphasize children's direct engagement with the real world as a meaningful source of learning. Rosita (2024) reported that children aged three to five years demonstrated significantly improved fine motor skills when natural materials were incorporated into creative activities. Similarly, Aisyiah and Pamungkas (2023) found that nature-based art activities positively influenced young children's creativity and learning interest. Furthermore, Rahmawati (2022) concluded that art activities involving the exploration of natural materials enhanced children's sensory sensitivity while fostering greater independence during exploration. Therefore, nature-based art activities should be viewed not only as a medium for self-expression but also as an innovative instructional strategy for optimizing early childhood sensorimotor development.

Despite the growing body of research, most previous studies have focused primarily on fine motor development and have not comprehensively examined the integrated relationship between sensory experiences (Sidiq et al., 2025) and motor development (Adatul'aisy et al., 2023), even though nature-based art activities (Aliriad et al., 2024) have been implemented in many early childhood education institutions. In addition, limited attention has been given to how teachers design learning strategies based on natural materials within the socio-cultural context of early childhood education settings (Aslamiyah et al., 2023; Rompas & Wijayanti, 2024). This research gap provides an important

rationale for the present study.

Based on preliminary observations and initial interviews with teachers at Tarbiyatul Islamiyah Playgroup, the institution has made considerable efforts to integrate natural elements into early childhood learning activities. Activities such as threading papaya leaf stalks, modeling with clay, and creating collages from seeds have become part of children's daily learning experiences. Nevertheless, these activities have not yet been systematically designed to optimize children's sensorimotor development, as teachers continue to encounter several challenges, including limited instructional time, variations in children's motor abilities, and insufficient training in implementing nature-based art activities. These conditions make Tarbiyatul Islamiyah Playgroup an appropriate setting for a case study because the institution is characterized by a supportive natural environment, abundant natural resources, and educators who are committed to implementing environmentally based learning. Accordingly, this study aims to describe in detail the implementation of nature-based art activities at Tarbiyatul Islamiyah Playgroup and to identify the factors that support and hinder their implementation in optimizing children's sensorimotor development.

Tarbiyatul Islamiyah Playgroup was selected as the research site because it actively implements learning activities that utilize environmental resources and locally available natural materials. Moreover, the school's surrounding environment provides abundant

natural resources that enable teachers to design a variety of creative art activities. Therefore, this study seeks to describe how nature-based art activities are implemented at Tarbiyatul Islamiyah Playgroup and to identify the factors that facilitate and constrain the optimization of early childhood sensorimotor development.

This study is expected to contribute conceptually to the field of early childhood education research while providing practical guidance for educators and early childhood education institutions in designing effective, contextual, and sustainable nature-based art activities to support children's optimal sensorimotor development.

Methods

This study employed a qualitative research approach using a case study design to describe the implementation of nature-based art activities and identify the factors that support and hinder the optimization of early childhood sensorimotor development. A qualitative approach was selected because it enables researchers to obtain an in-depth understanding of natural phenomena within their real-life context, while the case study design facilitates a comprehensive exploration of a particular phenomenon occurring in a specific educational setting.

The study was conducted at Tarbiyatul Islamiyah Playgroup, located in Driyorejo District, Gresik Regency, Indonesia, in November 2025. The research site was selected purposively because the institution actively implements learning activities that utilize natural materials

available in the surrounding environment. The participants consisted of 20 playgroup children aged 3–4 years and the classroom teacher who was directly involved in the learning activities. Participants were selected using purposive sampling, as they were considered the most relevant sources of information regarding the implementation of nature-based art activities at the institution.

The observed nature-based art activities included threading papaya leaf stalks, modeling with clay, and creating collages using various seeds. These activities were designed to stimulate children's hand–eye coordination, fine motor strength, and sensory sensitivity through direct exploration of natural materials found in the surrounding environment. Data were collected through participatory observation, in-depth interviews, and documentation of children's artwork. In this study, the researcher served as the primary research instrument and was supported by observation and interview guidelines to ensure systematic and comprehensive data collection.

The collected data were analyzed qualitatively using the interactive model of data analysis, which consisted of data reduction, data display, and conclusion drawing. These stages were conducted continuously and interactively throughout the research process. To ensure the trustworthiness of the findings, the study applied source triangulation and method triangulation. Furthermore, all research procedures adhered to ethical principles in early childhood research, including obtaining informed consent from the school and children's parents

before data collection commenced (Sugiyono, 2019).

Result and Discussions

Based on the findings from participatory observations and interviews with the playgroup teacher of children aged 3–4 years, nature-based art activities at Tarbiyatul Islamiyah Playgroup were systematically and contextually implemented by utilizing natural materials available in the surrounding school environment. Natural resources such as papaya leaf stalks, clay, and various seeds served as the primary learning media, providing children with direct and meaningful learning experiences. The use of these materials enabled children to actively engage in touching, observing, and manipulating objects, thereby providing optimal stimulation for early childhood sensorimotor development.

The first activity involved threading papaya leaf stalks. In this activity, papaya leaf stalks were cut into small perforated pieces, and children were asked to string them onto a cord to create bracelets or simple patterns. Observational findings indicated that this activity effectively enhanced children's hand–eye coordination and finger muscle strength. Most children remained focused throughout the activity, although some still required assistance from the teacher. These findings suggest that direct involvement in activities requiring precision and fine motor coordination gradually strengthens children's fine motor skills. This result is consistent with the findings of Mulya and Fitriyani (2024), who reported that threading activities using natural materials

effectively improve young children's fine motor skills through concrete and active learning experiences.

The second activity consisted of modeling with clay, which aimed to stimulate hand strength, sensory awareness, and creativity. During this activity, children performed various manipulative movements, such as pressing, rolling, and shaping clay into simple objects based on their imagination. The observations revealed that children were able to express their ideas freely through the objects they created while demonstrating improved finger strength and hand coordination. These findings indicate that exploring materials with different textures provides meaningful sensory experiences that support children's development. This finding is consistent with Nurjanah (2025), who concluded that three-dimensional art activities using plastic media such as clay can enhance children's creativity and fine motor skills through repetitive manipulative experiences.

The third activity involved creating collages using natural seeds. Children attached different types of seeds, including mung beans, corn kernels, and red rice grains, onto simple picture patterns that had been prepared by the teacher. This activity required careful attention, patience, and hand–eye coordination to position each seed accurately according to the pattern. The observations showed that children demonstrated a high level of enthusiasm throughout the activity and completed the task with varying degrees of independence. These findings indicate that collage activities using natural materials not only

improve fine motor skills but also foster concentration and children's ability to recognize shapes and sizes. This finding supports Sari (2022), who reported that incorporating natural materials into art activities contributes to the development of fine motor skills while encouraging perseverance among young children.

Throughout the implementation of nature-based art activities, the teacher assumed the role of a facilitator by providing instructions, demonstrations, and assistance according to each child's individual needs. Rather than directing the final outcome of children's artwork, the teacher encouraged children to explore and create independently. This instructional approach reflects the application of **scaffolding**, whereby adult support enables children to accomplish tasks that they are not yet able to complete independently. This finding supports Daniels (2016), who emphasized that social interaction and adult guidance play essential roles in helping children acquire new competencies through meaningful learning experiences.

In addition to examining the outcomes of the activities, this study also identified several supporting and inhibiting factors influencing the implementation of nature-based art activities. Supporting factors included the abundance of natural materials available within the school environment, teachers' creativity in transforming natural resources into learning media, children's enthusiasm during learning activities, and parental support in providing additional natural materials from home. Together, these factors created a conducive learning environment that

effectively supported the optimization of children's sensorimotor development.

However, several challenges were also identified during the implementation process. These included limited instructional time, variations in children's motor skill development, inadequate facilities for storing children's artwork, and limited teacher training related to the development of nature-based art activities. These constraints highlight the need for more effective time management, improved institutional support through adequate facilities, and continuous professional development opportunities for teachers to ensure that nature-based art activities can be implemented more effectively and sustainably.

Overall, the findings demonstrate that nature-based art activities utilizing materials from the surrounding environment provide effective stimulation for early childhood sensorimotor development. Children's active engagement in exploring natural materials, combined with the teacher's role as a facilitator, makes nature-based art activities a contextual, meaningful, and innovative learning strategy that is highly relevant for implementation in early childhood education.

Conclusion

The findings of this study demonstrate that nature-based art activities effectively optimize the sensorimotor development of early childhood at Tarbiyatul Islamiyah Playgroup. Through meaningful and hands-on learning experiences, the use of natural materials such as papaya leaf stalks, clay, and various seeds successfully enhanced

children's hand–eye coordination, fine motor strength, sensory sensitivity, concentration, and independence. These findings indicate that direct engagement with natural materials provides valuable opportunities for children to develop essential sensorimotor skills within an authentic learning context.

The implementation of nature-based art activities was supported by several facilitating factors, including the availability of natural materials in the school environment, teachers' creativity in designing learning activities, children's enthusiasm, and parental support. Nevertheless, several challenges remained, such as limited instructional time, variations in children's motor abilities, inadequate facilities, and limited teacher training related to nature-based art activities. These findings suggest the importance of strengthening institutional support, improving learning facilities, and providing continuous professional development for teachers to enhance the quality and sustainability of nature-based art learning.

Overall, nature-based art activities represent an innovative and contextual learning strategy that is highly relevant to early childhood education. By integrating natural resources into meaningful learning experiences, this approach contributes positively to the optimization of children's sensorimotor development and offers practical implications for educators seeking to create engaging, developmentally appropriate, and environmentally responsive learning environments.

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