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SCIENCE, TECHNOLOGY, ENGINEERING, ARTS, AND MATHEMATICS LEARNING WITH LOOSE PARTS TO FOSTER EARLY CHILDHOOD CREATIVITY IN ISLAMIC EDUCATIONAL INSTITUTIONS

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Abstrak: Perkembangan kreativitas anak usia dini di banyak lembaga pendidikan Islam masih belum optimal karena pembelajaran cenderung berpusat pada guru, minim eksplorasi, dan kurang menyediakan pengalaman bermain yang mendorong berpikir tingkat tinggi. Kondisi ini juga terjadi di TK Nurul Qur'an Stabat, di mana anak belum memperoleh kesempatan yang cukup untuk bereksperimen dan menghasilkan ide-ide orisinal. Penelitian ini bertujuan untuk mengetahui bagaimana penerapan pembelajaran berbasis STEAM (Science, Technology, Engineering, Arts, and Mathematics) menggunakan Loose Parts dapat meningkatkan kreativitas anak usia dini. Metode penelitian yang digunakan adalah kualitatif dengan pendekatan deskriptif melalui observasi, wawancara, dan dokumentasi. Hasil penelitian menunjukkan bahwa penggunaan Loose Parts dalam pembelajaran berbasis STEAM mampu meningkatkan kemampuan berpikir kreatif anak, terutama dalam aspek pemecahan masalah, inovasi, fleksibilitas, dan kemampuan menghasilkan ide baru. Anak menjadi lebih aktif, imajinatif, dan percaya diri dalam mengekspresikan gagasan. Temuan ini mengindikasikan bahwa integrasi STEAM dan Loose Parts tidak hanya efektif untuk meningkatkan kreativitas, tetapi juga relevan untuk memperkaya praktik pembelajaran di lembaga pendidikan Islam yang berorientasi pada pengembangan potensi anak secara holistik.

Kata Kunci: Kreativitas Anak Usia Dini, Pembelajaran STEAM, Loose Parts

Abstract: The development of creativity in early childhood within many Islamic educational institutions remains suboptimal because learning tends to be teacher-centered, offers limited exploration, and provides insufficient play experiences that stimulate higher-order thinking. This condition is also evident at Nurul Qur'an Stabat Kindergarten, where children have not yet gained adequate opportunities to experiment and generate original ideas. This study aims to examine how the implementation of STEAM-based learning (Science, Technology, Engineering, Arts, and Mathematics) using Loose Parts can enhance early childhood creativity. The research employed a qualitative method with a descriptive approach through observation, interviews, and documentation. The findings show that the use of Loose Parts in STEAM-based learning successfully improved children's creative thinking abilities, particularly in problem-solving, innovation, flexibility, and the ability to generate new ideas. Children became more active, imaginative, and confident in expressing their thoughts. These results indicate that the integration of STEAM and Loose Parts is not only effective in fostering creativity but also relevant for enriching learning practices in Islamic educational institutions that aim to develop children's potential holistically

Keywords: Early Childhood Creativity, STEAM Learning, Loose Parts Media

INTRODUCTION

The rapid development of science, digital technology, and social change in the modern era has had a major impact on education, including early childhood education (Jailani, 2014). Children growing up in the digital generation have different developmental needs compared to previous generations. They live amid a rapid flow of information, increasingly sophisticated technological devices, and higher demands for creativity and advanced thinking skills (Lubis et al., 2019). In this context, Islamic educational institutions are required to be able to provide innovative learning that not only supports cognitive development but also fosters creativity, imagination, problem-solving skills, and character building in accordance with Islamic values (Harahap et al., 2023; Munisa, 2020; Siregar et al., 2023). These challenges make it crucial to implement an exploration-oriented, active participation, and creative thinking approach to learning in Islamic educational institutions, especially at the early childhood education level (Koswara, 2018; Masganti, 2010).

The Science, Technology, Engineering, Arts, and Mathematics (STEAM) approach is one of the learning models relevant to addressing these needs. This model provides children with the opportunity to understand the basic concepts of science, technology, engineering, arts, and mathematics through an active, creative, and integrative exploration process. STEAM not only emphasizes cognitive aspects but also stimulates children's social, motor, and emotional skills through hands-on activities that are rich in meaningful learning experiences. Previous studies have mentioned that STEAM can improve investigative skills, creativity, problem solving, and collaboration in early childhood (Smith & Clements, 2020). However, most of these studies were conducted in public educational institutions, while studies on the implementation of STEAM in Islamic educational institutions are still very limited.

On the other hand, the use of Loose Parts in learning has become a pedagogical innovation that is gaining attention in early childhood development studies. Loose Parts refer to materials or objects that can be moved, combined, separated, or modified by children according to their creativity, such as stones, wood, bottle caps, twigs, cloth, cardboard, and various other open-ended materials. In the context of Islamic-based early childhood education, Loose Parts can also be integrated with Islamic values, such as the use of natural materials (natural *fitrah*), values of cleanliness, order, and responsibility. However, the integration of Loose Parts with the STEAM approach in Islamic educational institutions has rarely been studied, resulting in a literature gap.

The main problem that arises in Islamic educational institutions is that teacher-centered learning models are still prevalent, exploration is minimal, there is a lack of facilities that support children's creativity, and the learning approach does not optimize children's potential for critical and creative thinking from an early age. Many Islamic educational institutions also face limitations in terms of digital resources and modern teaching aids, requiring alternative learning models that are low-cost but still effective in developing creativity. In this case, the collaboration between STEAM learning

and Loose Parts is a potential opportunity because it can be introduced with simple, inexpensive, safe, and easily found materials, but is still able to develop children's creativity and thinking skills holistically.

This study was conducted to fill this theoretical and practical gap with the aim of analyzing how the implementation of Science, Technology, Engineering, Arts, and Mathematics learning with Loose Parts can enhance the creativity of early childhood in Islamic educational institutions. This study aims to identify the forms of STEAM and Loose Parts integration in the learning process, assess its effectiveness on children's creativity development, and explore Islamic values that can be synergized in these learning activities. Thus, this study focuses not only on pedagogical aspects but also on the relevance of Islamic values in the application of creative learning models for early childhood.

The uniqueness or distinction of this research lies in its attempt to combine the STEAM approach with Loose Parts specifically in Islamic educational institutions. Unlike previous studies that only highlighted the impact of STEAM on cognitive development or the influence of Loose Parts on children's creativity, this study places both in an integrated and contextual learning framework with Islamic values. Another distinction is the focus on implementation in Islamic educational institutions, which have different characteristics and educational demands than general institutions, including value orientation, learning culture, and the integration of Islamic character education.

The novelty of this research lies in four main aspects: first, the integration of two innovative approaches—STEAM and Loose Parts—into one learning design. Second, the emphasis on the context of Islamic education as an environment that requires creative learning models that still have religious value. Third, the use of Loose Parts not only as a medium for creative exploration, but also as a means of internalizing Islamic values such as order, simplicity, and appreciation for Allah's creation. Fourth, this research contributes to the development of early childhood learning theory from an Islamic perspective and a modern constructivist approach.

This study is expected to provide a theoretical contribution in the form of strengthening the literature related to the implementation of STEAM and Loose Parts in Islamic educational environments, as well as demonstrating that both approaches can be developed harmoniously with Islamic values. Practically, this research offers creative learning strategies ( ) that can be applied by educators in Islamic educational institutions despite limited resources. In addition, this research is expected to serve as a reference for educational institutions in designing learning activities based on exploration, innovation, and creativity that are appropriate for the needs of early childhood in the digital age without neglecting Islamic values.

METHOD

This study uses a qualitative method with a descriptive approach to gain an in-depth understanding of the implementation of Science, Technology, Engineering, Arts, and Mathematics learning with Loose Parts in fostering creativity in early childhood in Islamic educational institutions. The choice of qualitative method is based on the need

for the study to explore phenomena naturalistically, describe the learning process as it is, and capture the experiences of teachers and children comprehensively. This approach is relevant to the research objectives, which focus on in-depth exploration rather than quantitative measurement, especially since creativity, exploratory activities with Loose Parts, and the application of STEAM require direct observation in a natural context .

The research location was purposively selected at an Islamic educational institution that has implemented STEAM-based learning with Loose Parts. This location was chosen based on the consideration that Islamic educational institutions have different curriculum characteristics, value orientations, and pedagogical practices than general institutions, allowing researchers to explore how Islamic values are integrated into the creative learning process. The research informants consisted of classroom teachers, principals, and early childhood children who were directly involved in the learning process, with the number of informants adjusted according to the principle of information adequacy (Bungin, 2010).

Data collection was conducted through observation, in-depth interviews, and documentation studies. Observations were carried out in a moderately participatory manner in the classroom to see how children interacted with Loose Parts, how teachers integrated STEAM elements into play activities, and how Islamic values emerged in interactions and activities. Observations recorded not only physical activities, but also expressions of creativity, problem-solving processes, and children's social dynamics during the activities. In-depth interviews were conducted with teachers to explore their understanding of STEAM, how they designed activities, the forms of support or obstacles they experienced, and their perceptions of children's creativity development. Interviews with the principal were conducted to understand institutional policies and support for the implementation of innovative learning. A semi-structured interview approach was used so that researchers could explore new aspects that emerged in the field.

Supporting documents—such as child development records, activity portfolios, activity photos, and learning planning materials—were collected to strengthen the findings obtained through observations and interviews. These documents offer a longitudinal overview of changes in children’s creativity and illustrate the consistency of STEAM implementation using Loose Parts throughout the learning process.

Data analysis was conducted through thematic analysis with stages of data reduction, data presentation, and interactive conclusion drawing. Researchers examined all data to find patterns, categories, and relationships that describe how STEAM learning with Loose Parts affects children's creativity. This analysis also aimed to reveal the novelty of the research, namely the integration of two innovative approaches in the context of Islamic educational

institutions (Prameswari & Lestariningrum, 2020; Sardi, 2023; Violy et al., 2024).

Data validity is maintained through technical triangulation, source triangulation, and member checking. Technical triangulation is carried out by comparing the results of observations, interviews, and documentation. Source triangulation is done by confirming data from various informants. Member checking is done by asking informants to review the researcher's interpretations so that the findings remain accurate and contextually appropriate. With this method, the study is expected to produce a valid, comprehensive, and meaningful picture of the effectiveness of STEAM learning with Loose Parts in fostering creativity in early childhood in Islamic educational institutions.

RESULTS AND DISCUSSION

Implementation of Science, Technology, Engineering, Arts, and Mathematics Learning with Loose Parts

The implementation of Science, Technology, Engineering, Arts, and Mathematics learning with Loose Parts in early childhood education in Islamic educational institutions presents a unique pedagogical landscape because it integrates exploration, creativity, and value-based learning. At Nurul Qur'an Stabat Kindergarten, the application of this learning model for three months showed not only how children engaged with Loose Parts to enhance creativity, but also how the Islamic educational environment shaped the meaning and direction of their activities. Eight observed STEAM sessions revealed a consistent pattern: children immersed themselves in open-ended materials, teachers facilitated inquiry through reflective questions, and learning took place through exploration connected to real-life themes. This dynamic confirms that creativity in early childhood is closely related to opportunities for experimentation, meaningful interaction, and emotional support (Koswara, 2018) .

Children's involvement in the exploration phase demonstrates the basic process of creativity development through sensory and cognitive stimulation. When introduced to a variety of Loose Parts—small stones, seeds, buttons, popsicle sticks, and cardboard—children do not simply hold objects, but are building an initial understanding of science and mathematics concepts. Observations show that children naturally group objects by color and shape, predict outcomes when stacking or arranging materials, and test hypotheses through teachers' prompting questions . For example, when the teacher asks, "What happens if we add one more stone on top?" children respond through direct experimentation, not verbal explanations. These findings confirm that children develop higher-level cognitive skills through direct investigation, not passive instruction (Nimawati & Zaqiah, 2020).

During the design and testing phase, engineering concepts emerge naturally. Children try to build sturdy towers, balanced bridges, and moving vehicles from bottle caps and rubber bands. This process reveals variations in persistence, problem-solving strategies, and collaborative behavior. Some children carefully calculated materials, while others relied on intuition by stacking objects repeatedly until they achieved stability. The trial-and-error behavior that emerged confirms

that Loose Parts learning is in line with constructivist principles, where mistakes are an integral part of the meaning-making process. Mathematical thinking was evident when children compared sizes, grouped objects, and negotiated sizes to determine the most effective design. These findings reinforce Nisrokha's argument(2020) that early engineering experiences integrated with mathematics strengthen spatial reasoning, logical thinking, and planning skills.

The stage of creation and self-expression describes the meeting between creativity and emotional expression. Children decorate their structures using natural and artificial Loose Parts, while giving symbolic meaning to their work. For example, one child named his work Happy Home and explained that the colored buttons symbolized his family members. This shows that artistic expression in STEAM activities serves as a medium for children to communicate personal experiences and social understanding. Moments like this highlight one of the novel aspects of this research: STEAM with Loose Parts in an Islamic educational environment not only enhances cognitive creativity, but also fosters social-emotional and moral dimensions. Children often associate Islamic values—such as gratitude for nature or the importance of working with friends—in their verbal reflections, showing that the institutional context also shapes their creative narratives (Nawanti et al., 2025; Rahmatullah et al., 2022; Violy et al., 2024).

Reflection sessions reveal deeper metacognitive development. When children describe the challenges they faced during the construction process or express their intention to improve their work in the future, they demonstrate an early ability to evaluate their thinking. The teacher's reflective questions encourage children to articulate their reasons, recognize difficulties, and propose new ideas. This process is in line with the main objectives of STEAM education, namely to foster problem-solving and critical thinking skills. These findings also emphasize the importance of teacher facilitation. Teachers at Nurul Qur'an Stabat Kindergarten consistently provide emotional support, guide exploration without limiting creativity, and provide scaffolding as needed. This pedagogical practice is consistent with Rohayati (2018), which emphasizes that teachers should act as facilitators, not merely instructors, in creative learning environments.

Thematic activities further enrich children's learning. In the vehicles theme, children combine engineering and science concepts by observing motion and stability when making cars from Loose Parts. The home theme encourages spatial awareness and symmetry, while also providing space for cultural and religious connections when children draw family members. The ocean and fish theme fosters biological observation and artistic representation through shells, buttons, and seeds (El-Khuluqo, 2015). These themes demonstrate how STEAM with Loose Parts transforms abstract concepts into real, child-friendly experiences.

The children's work appears to be very diverse, demonstrating originality and flexibility of ideas—indicators of divergent thinking (Masganti, 2010). Whether building a three-legged house or an ant bridge, children demonstrate the ability to imagine shapes

outside of conventional patterns. In addition, the collaborative nature of these sessions strengthens social-emotional skills. Children communicate ideas, negotiate roles, share materials, and solve problems together. This behavior aligns with (2017), which states that cooperative learning environments enhance communication skills and empathy.

Overall, this study shows that STEAM learning with Loose Parts in early childhood Islamic education significantly improves creativity, cognitive development, and collaborative skills (Basyiroh, 2017). Furthermore, this study contributes to the field by demonstrating that STEAM and Loose Parts can be meaningfully integrated with Islamic values to produce a holistic form of creativity—combining imagination, problem solving, collaboration, and character development. These findings confirm that open-ended materials, guided inquiry, and values-based facilitation create a powerful synergy in nurturing the creative potential of early childhood in the 21st century.

The Development of Creativity in Children at Nurul Qur'an Stabat Kindergarten

The development of children's creativity after implementing STEAM-based learning with Loose Parts at Nurul Qur'an Stabat Kindergarten showed transformative changes, both measurable and directly observable. Over the three-month implementation period, children aged 5–6 years, who initially showed only limited imaginative expression, began to display richer creativity, characterized by fluency of thought, flexibility, originality, and elaboration. These changes were revealed through triangulation of observations, interviews, and documentation, in accordance with the descriptive qualitative method of . It is important to note that a learning environment based on Islamic educational values provides an additional contextual foundation that shapes children's attitudes, motivation, and social interactions during the creative process.

The earliest and most noticeable changes appeared in the aspect of fluency of thinking. At first, most children only gave one or two answers when asked open-ended questions and produced repetitive or uniform work because they were accustomed to imitating their teachers' examples. However, with the introduction of Loose Parts through STEAM exploration, this pattern began to change gradually. Children began to generate many ideas at once and demonstrated the ability to transform the same materials into different forms. One child, for example, when asked to make an animal from Loose Parts, was able to make four different representations—ranging from fish to birds—using the same objects. This demonstrates what is called associative fluency (Nimawati & Zaqiah, 2020) as the emergence of associative fluency: the ability to generate many ideas in a short time without being bound to a single pattern of thinking. This increase in fluency is also influenced by the nature of Loose Parts, which have no fixed function and thus stimulate divergent thinking.

Flexibility also increased significantly when children learned to adjust their strategies when encountering obstacles. Before the STEAM intervention, children often abandoned tasks when their structures collapsed or did not meet their expectations.

Through repeated engineering-themed activities, they began to try various alternative approaches—adding supports, replacing materials, or asking friends for help. This change reflects the development of adaptive flexibility, which according to Nurhayati et al. (2019) is a characteristic of creative resilience at an early age. A learning environment that accepts mistakes—as is characteristic of STEAM—makes failure feel normal and even productive, reinforcing the idea that creativity is formed through repeated problem solving, not perfect results from the outset.

Originality emerged as the most prominent indicator of change. Prior to the intervention, classroom activities were largely dominated by imitation, driven in part by conventional teaching practices that emphasized model-based examples. However, after three months of implementing STEAM learning, the children began producing creations that no longer resembled either the teacher's models or their peers' work. Imaginative outputs—such as a curved bridge designed for small animals, a multi-story house built with leaves, or a space vehicle constructed from bottle caps—demonstrated the development of unique conceptualizations. These products reflect the internalization of creative autonomy, the fusion of imagination with lived experience, and the ability to conceptualize novel forms, consistent with the findings of Farikhah et al. (2022). This growing originality signifies not only cognitive advancement but also increased confidence in expressing unconventional ideas, a key competency in 21st-century learning.

Elaboration also increased when children began to enrich their creations with meaningful details. Whereas previously their creations were simple and lacked detail, after the intervention they began to add more complex elements, such as decorations, additional functions, or narrative explanations. Children who added a "sponge bed" and a "coconut leaf roof" to their miniature houses demonstrated a deeper level of elaborative thinking. Another child's explanation—This is a bridge for ants to cross the river, and underneath is a hiding place when it rains—shows how children are increasingly able to connect their ideas to a broader context and symbolic meaning (Mayar et al., 2022). This improvement also shows the development of language skills and metacognitive awareness, as children can explain the reasons behind their creative choices.

The changes that occur are not only cognitive but also attitudinal and socio-emotional. Children become more confident, communicative, and collaborative. Children who were previously passive begin to be proactive, propose new ideas, invite friends to work together, and actively participate in discussions. They also show openness in presenting their work and explaining the concepts they have created. The dare to try attitude, accompanied by a reduced fear of making mistakes, signifies a shift towards a growth mindset—an important goal in Islamic-based early childhood education that emphasizes perseverance (istiqamah), cooperation (ta'awun), and responsible action (Munisa, 2020; Nofianti et al., 2021; Siregar et al., 2023; Widya et al., 2020).

Quantitative data further illustrates the magnitude of these changes. In the category of thinking fluency, 62.5% of children showed

excellent development, an increase of 233%. Flexibility increased in 56.25% of children, with an increase of 350%. Originality increased in 50% of children, with an increase of 300%, while elaboration increased in 68.75% of children, with a growth of 175%. This sharp increase shows that STEAM learning with Loose Parts, when applied consistently and supported by reflective facilitation, can systematically improve various dimensions of creativity. These findings indicate that creativity develops through gradual exposure to open challenges, opportunities to make decisions, and active involvement in meaningful design processes.

An important contribution of this study lies in its contextual relevance to Islamic-based early childhood education. Learning activities reinforce values such as cooperation, appreciation of natural materials as God's creation, patience during the trial and error process, and gratitude for success. Children express these values in reflection sessions, demonstrating that creativity development does not occur in isolation, but within an ethical and spiritual framework. This is a novelty in the literature: the integration of STEAM, Loose Parts, and Islamic pedagogical values that simultaneously foster creativity and character.

In conclusion, the development of creativity at Nurul Qur'an Stabat Kindergarten demonstrates that STEAM learning with Loose Parts effectively enhances fluency, flexibility, originality, and elaboration, while simultaneously strengthening children's self-confidence and socio-emotional competencies. These findings affirm that well-designed exploratory learning within an Islamic education setting can prepare young children not only cognitively but also holistically—integrating creativity, collaboration, and character formation to equip them for the demands of the 21st century (Siregar et al., 2023; Widya et al., 2020).

Key Findings and Novelty of the Research

The results of the study show that the application of Science, Technology, Engineering, Arts, and Mathematics learning using Loose Parts in Islamic educational institutions has a significant impact on the development of creativity in early childhood. The main findings of this study show that the STEAM approach combined with Loose Parts not only improves children's problem-solving abilities but also strengthens their imaginative, collaborative, and exploratory capacities, which have been lacking in traditional learning patterns. During the learning process, children appear to be more proactive in asking questions, trying, and testing various ideas through the loose materials provided. This phenomenon shows that Loose Parts serve as a stimulus that simultaneously stimulates motor, verbal, and cognitive creativity.

Other findings show that children involved in STEAM–Loose Parts activities experience increased independence in thinking. They are able to develop initiative in choosing materials, determining the form of the project, and completing tasks without relying too much on the teacher's instructions. At the same time, the natural process of discussion and group work helps foster social creativity, which is the ability of children to combine ideas, negotiate, and create solutions together. This is in line with the principles of

constructivist learning, which emphasizes the importance of direct experience and social interaction as the foundation for creativity.

In addition, this study found that the integration of Islamic values in the context of STEAM learning gives it a distinctive character that sets it apart from similar studies. The reinforcement of religious values such as honesty, cooperation, gratitude for God's creation, and responsibility for the tasks assigned appears to be integrated with the children's scientific exploration process. Teachers facilitate the relationship between exploratory activities and spiritual values, for example, by inviting children to reflect on the diversity of shapes and functions of objects as signs of Allah's greatness. This integration results in creativity that is not only cognitive and artistic but also character-oriented, making it more in line with the vision of Islamic educational institutions.

From a methodological perspective, the findings of this study confirm that the use of Loose Parts as a medium in STEAM learning provides the flexibility and freedom needed for children to develop high levels of creativity. Children can change, arrange, and modify materials as needed, so that the creative process becomes more natural and is not limited by fixed forms or functions. This pattern of play produces more varied creative outputs compared to conventional learning media, which are fixed and structured.

The main novelty of this study lies in the integration of the STEAM approach, the Loose Parts concept, and Islamic values into a comprehensive learning model for developing creativity in early childhood. Few previous studies have examined in depth how STEAM–Loose Parts learning is implemented in the context of Islamic educational institutions, especially how teachers connect scientific and artistic exploration processes with religious character building. This study also contributes new insights by mapping indicators of creativity that emerge naturally in the context of Islamic learning, such as creativity reflected in polite behavior, social awareness, and spiritual awareness.

Overall, this study provides new insights into how STEAM learning with Loose Parts can be an innovative strategy for enhancing creativity in early childhood education in Islamic educational institutions. This approach is not only pedagogically effective, but also relevant to the needs of character building and spiritual values in contemporary Islamic education.

CONCLUSION

The conclusion of this study shows that the application of Science, Technology, Engineering, Arts, and Mathematics learning with Loose Parts at Nurul Qur'an Stabat Kindergarten significantly improves the development of early childhood creativity in various dimensions—fluency of thinking, flexibility, originality, and elaboration. During the three months of implementation, the children showed a clear shift from imitative thinking to divergent thinking through exploration, experimentation, and natural constructive processes. Engineering, design, testing, and artistic expression activities through Loose Parts not only strengthened cognitive and problem-solving abilities but also fostered courage to take risks, curiosity, and resilience in the face of failure. Positive

changes were also seen in social-emotional aspects, such as increased cooperation, communication, and self-confidence. Another important conclusion is that the integration of STEAM with Loose Parts in the context of Islamic educational institutions can provide holistic learning. Islamic values—such as gratitude, cooperation, perseverance, and a sense of responsibility—appear naturally in children's reflections and interactions, showing that creativity can develop in line with character building. Thus, this study confirms that the STEAM–Loose Parts approach is an effective and innovative strategy for fostering creativity in early childhood while strengthening value-based learning in Islamic educational institutions.

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