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Islamic Education Perspective in Center-Based Learning for Early Childhood Executive Functions

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Abstract:
The development of executive functions in early childhood is a crucial foundation for later academic readiness; however, learning practices in early childhood education still tend to be teacher-centered and less contextual. This study examines the implementation of the Center-Based Learning model integrated with the traditional Bima game Mpa'a Ncimi Lombo Tembe within the perspective of Islamic education as an effort to enhance children's executive functions. The scope of the study focuses on three core components of executive function: inhibitory control, working memory, and cognitive flexibility. The aim of this study is to determine the effectiveness of the Center-Based Learning model integrated with the traditional Bima game Mpa'a Ncimi Lombo Tembe in improving early childhood executive functions. This study employed a quantitative approach using a quasi-experimental design with a non-equivalent control group design. The participants consisted of 40 children aged 5–6 years, divided into experimental and control groups. Data were collected through structured observation and executive function assessment instruments and analyzed using independent sample t-test and paired sample t-test at a significance level of 0.05. The results revealed a significant difference between the experimental and control groups in the posttest ($t = 6.32$; $p < 0.05$), with a higher gain score in the experimental group (21.70) compared to the control group (10.45). These findings indicate that structured and contextual play-based learning effectively enhances children's executive functions. Furthermore, the integration of Islamic educational values contributes to holistic character development.

Keywords: *center-based learning, traditional games, executive function, Islamic education, early childhood*

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INTRODUCTION

Early childhood cognitive development constitutes a fundamental foundation for learning readiness at subsequent levels of education, particularly in the domains of inhibitory control, working memory, and cognitive flexibility, which are integrated within executive function (Kucab et al., 2025). These functions play a crucial role in shaping children's capacity to regulate behavior, sustain attention, and solve problems adaptively. In Early Childhood Education (ECE) contexts, however, learning practices remain predominantly teacher-centered and are often insufficiently contextualized, with limited use of meaningful play as a medium for optimizing cognitive and socio-emotional development. In addition, contemporary educational demands in the 21st century and the era of Industrial Revolution 5.0 emphasize the importance of learning approaches that not only develop cognitive competencies but also integrate humanistic, moral, and value-based dimensions, including religious education as part of holistic child development (Muir & Steven J. Howard, 2024). Within this framework, Islamic education is relevant because it positions learning as a process of holistic character formation *(tarbiyah and ta'dib),* where cognitive development is inseparable from the cultivation of moral and behavioral values such as discipline, responsibility, patience, and social cooperation. Therefore, the inclusion of an Islamic education perspective in this study is conceptually justified as it provides an ethical and value-based foundation that complements cognitive development in early childhood.

This condition indicates a gap between the need to strengthen children's executive functions and the instructional strategies currently implemented in classrooms, thereby necessitating relevant empirical investigation (Nasution, Wiraningtyas, Nurmaya, Ahyansyah, & Mawaddah, 2024). Several previous studies indicate that contextual learning approaches, such as Case-Based Learning (CBL), make a significant contribution to enhancing higher-order thinking skills through active engagement in real-world problem solving (Alfiandra1 et al., 2022; Marini et al., 2026). Experimental research conducted by Simbolon and Dharmayanthi further demonstrates that case-based learning models are effective in improving critical thinking skills and learning outcomes (Putu & Dharmayanthi, 2022; Simbolon, 2022). However, most of these studies have been conducted at the secondary and tertiary education levels and therefore do not fully address the developmental characteristics of early childhood learners. On the other hand, research on traditional game-based learning reveals considerable potential in fostering children's cognitive and socio-emotional development through contextual and meaningful activities. Nevertheless, studies that integrate the Center-Based Learning model, Bima traditional games, and an Islamic education perspective in the development of early childhood executive functions remain limited. Therefore, this study occupies a significant position in addressing this gap by integrating pedagogical approaches, local wisdom, and Islamic educational values within a unified learning framework.

Theoretically, play activities that are structured around rules, strategy, and social interaction are believed to optimally stimulate children's executive functions. Traditional Bima games, such as *Mpa'a Ncimi Lombo Tembe*, incorporate elements of turn-taking, behavioral regulation, and adaptation to changing situations, all of which are relevant to the development of inhibitory control, working memory, and cognitive flexibility. From the perspective of Islamic education, structured play activities also function as a medium for

character formation through the habituation of values such as discipline, patience, responsibility, and cooperation, which are aligned with the concept of ta'dib. Therefore, the integration of a Center-Based Learning model based on Bima traditional games within the framework of Islamic education is assumed to have a positive effect on enhancing early childhood executive functions.

The aim of this study is to determine the level of effectiveness of the Center-Based Learning model integrated with the traditional Bima game Mpa'a Ncimi Lombo Tembe, viewed from an Islamic education perspective, in improving early childhood executive functions. This study employed a quantitative approach using a quasi-experimental method with a non-equivalent control group design (Creswell & Creswell, 2018). Data were collected through structured observation and executive function assessment instruments encompassing inhibitory control, working memory, and cognitive flexibility (Diamond, 2012). Prior to implementation, the research instruments were tested for content validity through expert judgment and for reliability using Cronbach's Alpha coefficient to ensure the accuracy and consistency of the measurements. Data analysis was conducted using inferential statistical techniques, including normality and homogeneity tests, as well as independent samples t-tests and paired samples t-tests at a significance level of 0.05 to examine differences and improvements between the experimental and control groups (Field, 2018).

RESULTS AND DISCUSSION

This section presents the findings of the study concerning the effectiveness of the Center-Based Learning model integrated with the traditional Bima game Mpa'a Ncimi Lombo Tembe from an Islamic education perspective in improving early childhood executive functions. The results are organized into several stages of analysis, including descriptive statistics of pretest and posttest scores, prerequisite testing through normality and homogeneity analyses, and hypothesis testing using independent samples t-test and paired samples t-test. The findings are intended to provide empirical evidence regarding differences between the experimental and control groups as well as improvements in inhibitory control, working memory, and cognitive flexibility following the implementation of the intervention.

This study involved 40 children aged 5–6 years, divided into two groups: 20 children in the experimental group and 20 children in the control group. Data analysis was conducted through prerequisite tests (normality and homogeneity) and hypothesis testing using independent samples *t*-test and paired samples *t*-test at a significance level of 0.05.

Descriptive Statistics of Pretest and Posttest

Tabel 1. Descriptive Statistics of Executive Function Scores

Group	N	Pretest (Mean ± SD)	Posttest (Mean ± SD)	Gain Score
Experimental	20	60.45 ± 5.21	82.15±6.02	21.70
Control	20	59.80 ± 5.47	70.25 ± 5.88	10.45

Source: Author 2026

Based on Table 1, the initial mean scores of both groups were relatively equivalent. After the intervention, the experimental group demonstrated a substantially higher increase compared to the control group.

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Normality and Homogeneity Tests

Tabel 2. Results of Normality Test (Kolmogorov–Smirnov)

Group	Pretest (Sig.)	Posttest (Sig.)	Interpretation
Experimental	0.200	0.176	Normal
Control	0.189	0.154	Normal

Source: Author 2026

All significance values exceeded 0.05, indicating that the data were normally distributed..

Tabel 3. Results of Homogeneity Test (Levene's Test)

Data	Sig.	Interpretation
Pretest	0.742	Homogeneous
Posttest	0.681	Homogeneous

Source: Author 2026

The significance values were greater than 0.05, indicating that the variances of the two groups were homogeneous.

Difference in Mean Scores Between Groups

Tabel 4. Results of Independent Samples t-test

Kelompok	Pretest (Sig.)	Posttest (Sig.)	Interpretation
Pretest	0.39	0.690	Not significant
Posttest	6.32	0.000	Significant

Source: Author 2026

The test results indicate that there was no significant difference between the experimental and control groups at the pretest stage. However, a statistically significant difference was found at the posttest stage, suggesting that the treatment had a measurable effect on the experimental group compared to the control group.

Within-Group Improvement Analysis

Tabel 5. Results of the Paired Sample t-test for the Experimental Group

Aspect	Mean Pre	Mean Post	t-hitung	Sig.
Inhibitory Control	61.10	84. 20	9.45	0.000
Working Memory	59.80	81.40	8.97	0.000
Cognitive Flexibility	60.45	80.85	8.11	0.000

Source: Author 2026

Tabel 6. Results of Paired Samples t-test (Control Group)

Aspect	Mean Pre	Mean Post	t-hitung	Sig.
Inhibitory Control	60.75	71.30	3.12	0.005
Working Memory	58.95	69.85	2.98	0.007
Cognitive Flexibility	59.70	69.60	2.76	0.012

Source: Author 2026

Tables 5 and 6 show that both groups experienced improvements across all measured aspects. However, the *t*-values and mean differences in the experimental group were substantially higher than those in the control group, with a significance level of 0.000 across all indicators. This indicates that the intervention had a stronger effect in enhancing executive functions compared to conventional learning approaches.

Before discussing the findings of this study, it is important to first explain the Islamic education perspective underlying the implementation of the Center-Based Learning model integrated with the traditional Bima game *Mpa'a Ncimi Lombo Tembe*. In Islamic education, learning is fundamentally oriented toward the holistic development of human beings (*insan kamil*), encompassing cognitive, affective, moral, and spiritual dimensions. Education is not only aimed at knowledge acquisition, but also at character formation (*tarbiyah wa ta'dib*), which emphasizes the internalization of ethical and behavioral values in everyday life (Roni Irawan, 2020).

In this context, this research associates the Center-Based Learning model with the traditional game *Mpa'a Ncimi Lombo Tembe* as a form of integrative learning that combines pedagogical, cultural, and Islamic educational values. The learning process is designed to provide structured play experiences that enable children to develop cognitive abilities while simultaneously internalizing moral values grounded in Islamic teachings.

The integration of Islamic educational values in this study is reflected in several key indicators derived from Islamic education literature and supported by previous studies, including discipline (*al-intizam*), responsibility (*amanah*), cooperation (*ta'awun*), patience (*sabr*), honesty (*sidq*), and mutual respect (*ihtiram*) (Farihin & Bahrani, 2025; Suprijanto & Nasution, 2025).

These indicators are operationalized in learning activities through habituation (*ta'wid*) during play, where children repeatedly practice rule-following, turn-taking, emotional regulation, and social cooperation. This process shows that Islamic education values are not only theoretical constructs but are actively embedded in experiential learning contexts.

The Effect of a Center-Based Learning Model Based on Traditional Games on Children's Executive Functions

The results of the study revealed a significant difference between the experimental and control groups at the posttest stage ($t = 6.32$; $p < 0.05$). The mean executive function score of the experimental group increased from 60.45 to 82.15, while the control group improved from 59.80 to 70.25. The gain score of the experimental group was 21.70 points, which was higher than that of the control group at 10.45 points. These findings indicate that the

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implementation of the Center-Based Learning model based on the traditional game *Mpa'a Ncimi Lombo Tembe* exerted a stronger effect than conventional learning in enhancing children's executive functions.

From the perspective of Islamic education, structured play activities, as reflected in traditional games, function not only as cognitive stimulation but also as a medium for character *(akhlaq)* formation (Roni Irawan, 2020). Values such as discipline in following rules, patience in waiting for turns, responsibility, and cooperation (*ta'awun*) represent fundamental principles in Islamic education that align with the development of children's executive functions (Nafal et al., 2024). Therefore, the observed improvement in executive functions reflects not only the development of cognitive capacities but also the contextual internalization of moral and religious values.

Theoretically, executive functions consist of three main components: working memory, inhibitory control, and cognitive flexibility (Nasution, Wiraningtyas, Nurmaya, Ahyansyah, & Mawaddah, 2024; Nasution & Ahyansyah, 2024). This concept has been extensively developed in developmental neuropsychology, particularly by Adele Diamond, who emphasizes that executive functions develop optimally through activities that require self-regulation, problem-solving, and attentional control within meaningful social contexts. In the traditional game *Mpa'a Ncimi Lombo Tembe*, children are required to remember game rules (working memory), inhibit impulses or wait for their turn (inhibitory control), and adjust strategies when situations change (cognitive flexibility). Thus, the characteristics of this game directly train the core components of executive functions.

From the perspective of cognitive constructivism proposed by Jean Piaget, children construct knowledge through active interaction with their environment. The Center-Based Learning model provides a learning environment that enables children to explore, manipulate, and reflect on their play experiences concretely. Activities in learning centers encourage processes of assimilation and accommodation, thereby enriching children's cognitive structures, including the strengthening of self-control and flexible thinking abilities (Kucab et al., 2025).

In line with this, Lev Vygotsky's social constructivist theory emphasizes the importance of social interaction and scaffolding in the development of higher mental functions. Traditional games implemented within a center-based setting create opportunities for collaboration, rule negotiation, and communication among children. These interactions establish a zone of proximal development (ZPD), where children receive support from peers and teachers to achieve higher levels of self-regulation (Hakim et al., 2025). Consequently, the development of executive functions occurs not only individually but also through structured social dynamics.

The play-based learning approach in early childhood education highlights that play is a natural medium for cognitive and socio-emotional development. Play activities that involve clear rules and specific goals have been shown to be effective in strengthening self-regulation and concentration (Shih, 2022). This explains why the improvement in scores among the experimental group was more significant than in the control group, which relied on conventional, teacher-centered approaches. Thus, both empirically and theoretically, it can be concluded that the Center-Based Learning model based on the traditional game *Mpa'a Ncimi Lombo Tembe* has a strong foundation in cognitive and social development theorie (Mansour et al., 2025). This model is capable of comprehensively stimulating children's executive functions through active, contextual learning experiences that emphasize meaningful social interaction (Hakim et al., 2025). These findings reinforce the

assumption that the integration of local wisdom into instructional design is not only culturally relevant but also psychopedagogically effective in supporting the development of executive functions in early childhood.

Improvement in Inhibitory Control, Working Memory, and Cognitive Flexibility

The indicator-based analysis shows that all aspects of executive function in the experimental group experienced significant improvement ($p < 0.05$). In the aspect of inhibitory control, the mean score increased from 61.10 to 84.20 ($t = 9.45$). This improvement indicates that the structured rules of the game, turn-taking system, and the application of consequences in the traditional game *Mpa'a Ncimi Lombo Tembe* effectively trained children's ability to inhibit impulsive responses, follow instructions, and regulate behavior. Theoretically, inhibitory control is a fundamental component of self-regulation that strongly determines children's readiness to learn. Adele Diamond emphasizes that activities requiring adherence to rules and motor response control significantly strengthen the prefrontal cortex networks responsible for self-regulation (Diamond, 2012). Thus, game characteristics rich in rules and social monitoring provide relevant stimulation for the development of this aspect.

In the domain of working memory, the score increased from 59.80 to 81.40 ($t = 8.97$). Game activities that require children to remember sequences of actions, strategies, symbols, and teacher instructions contribute to strengthening short-term information storage and processing capacity. From the perspective of cognitive development theory, Jean Piaget explains that children construct cognitive schemas through manipulative activities and concrete experience (Hanifah et al., 2024). When children are directly engaged in play, they not only retain information but also organize it into more complex cognitive structures. Furthermore, within a sociocultural framework, Lev Vygotsky highlights the importance of social interaction and dialogue in strengthening higher mental functions, including working memory. Peer interactions during play facilitate memory reinforcement through repetition, clarification, and collaborative correction(Nasution, Wiraningtyas, Nurmaya, Ahyansyah, Mawaddah, et al., 2024).

In line with this, Islamic education emphasizes habituation as a primary method for character development. Social interaction within play activities provides opportunities for children to learn values of *adab*, such as respecting others, following rules, and cooperating (Pratiwi et al., 2025). This indicates that play-based learning is not only relevant from a developmental psychology perspective but also aligned with the principles of Islamic education in shaping morally grounded and cognitively capable individuals(Walsh et al., 2024).

In the aspect of cognitive flexibility, the score increased from 60.45 to 80.85 ($t = 8.11$). This improvement suggests that children became more capable of adjusting strategies when facing changing situations, additional rules, or dynamic interactions during play. Cognitive flexibility reflects the ability to shift perspectives and adapt thinking patterns effectively (Hardiyanti et al., 2025). In developmental neuropsychology, this ability develops optimally when children are exposed to problem-solving situations that require rapid and appropriate response adjustments. Dynamic traditional games provide opportunities for children to experiment with various strategies, thereby fostering divergent and adaptive thinking skill (Fauziah et al., 2020).

Compared to the control group, which showed lower improvements across all indicators, these findings confirm that stimulation through traditional games integrated into the Center-Based Learning model is more effective in enhancing children's executive

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functions (Anggryani, Kartikasari, et al., 2025). This is consistent with the play-based learning approach in early childhood education, which positions play as a primary medium for cognitive and socio-emotional development (Zhong et al., 2025). Therefore, both empirically and theoretically, it can be concluded that integrating traditional games into center-based learning not only strengthens local cultural values but also makes a significant contribution to the development of inhibitory control, working memory, and cognitive flexibility as core components of children's executive functions (Liu et al., 2021).

The Relevance of Local Culture in Strengthening Early Childhood Education (ECE) Learning

The findings of this study not only demonstrate statistical effectiveness but also carry significant pedagogical and cultural implications. The integration of the traditional game *Mpa'a Ncimi Lombo Tembe* into the Center-Based Learning model enhances the contextual relevance of learning in ECE settings in Bima City. Children learn through activities that are closely connected to their social experiences and cultural environment, making the learning process more meaningful, authentic, and accessible. Contextual learning enables children to relate play experiences to real-life situations, thereby fostering an integrated connection among cognitive, social, and emotional aspects (Paraskevopoulou-Kollia et al., 2025)

Theoretically, this approach aligns with the sociocultural perspective developed by Lev Vygotsky, who emphasized that children's cognitive development cannot be separated from the social and cultural contexts in which they grow (Yordudom et al., 2025). Culture functions as a medium for the internalization of values, norms, and interaction patterns that shape higher mental functions (Ocak et al., 2025). When traditional games are integrated into center-based learning, children not only practice executive functions but also internalize values such as cooperation, rule compliance, sportsmanship, and appreciation of local cultural heritage (Anshul et al., 2020). hus, the learning process becomes both a medium of cultural transmission and a means of strengthening cognitive capacity (Anggryani, Imaniar, et al., 2025).

Moreover, this approach is consistent with the principles of humanistic education, which position children as active subjects in the learning process. Through play activities rooted in local culture, children experience enjoyable learning that remains connected to their social identity (Na et al., 2024). This is particularly important in early childhood education, which emphasizes holistic development integrating cognitive, socio-emotional, moral, and cultural dimensions in a balanced manner (Yang, 2025).

A local culture-based approach also addresses the issues identified in the research introduction, particularly the dominance of less contextual learning practices that have not yet optimally stimulated children's executive functions. Teacher-centered learning models tend to limit children's opportunities for exploration and active participation (Budhi Santosa et al., 2024). In contrast, the Center-Based Learning model grounded in traditional games offers broader, more meaningful, and more structured opportunities for interaction, exploration, and reflection. Through this approach, children not only develop self-regulation and cognitive control, but also strengthen their collective awareness, social sensitivity, and cultural identity (Siswanto et al., 2024).

In the context of education in the era of the Industrial Revolution 5.0, which emphasizes a balance between technological advancement and human values, the integration of local culture into ECE learning becomes increasingly relevant. Strengthening executive functions must go hand in hand with reinforcing humanistic values and local

wisdom to ensure that education does not lose its socio-cultural dimension (Nudin et al., 2024) . Therefore, the Center-Based Learning model based on traditional games is proven not only empirically effective in enhancing executive functions but also contextually relevant in supporting holistic early childhood development rooted in cultural identity (Banić & Orehovački, 2024).

In the context of Bima society, which maintains a strong attachment to Islamic values, the integration of traditional games into learning also serves as a medium for internalizing religious values embedded within local culture. Learning thus becomes not only a process of knowledge transmission but also a means of character formation aligned with both Islamic values and local wisdom. Accordingly, the Center-Based Learning model based on Bima traditional games, viewed from an Islamic education perspective, is not only effective in improving early childhood executive functions but also contributes to shaping children's character fostering discipline, patience, and cooperation as integral components of Islamic educational values.

CONCLUSION

Based on the results of the analysis and discussion, it can be concluded that the implementation of the Center-Based Learning model based on the Bima traditional game *Mpa'a Ncimi Lombo Tembe*, viewed from the perspective of Islamic education, has a significant effect on improving early childhood executive functions. This is evidenced by a significant difference between the experimental and control groups at the posttest stage ($t = 6.32$; $p < 0.05$), with the mean score of the experimental group increasing from 60.45 to 82.15 (gain score = 21.70), while the control group increased from 59.80 to 70.25 (gain score = 10.45). These improvements encompassed all aspects of executive function, namely inhibitory control (61.10 to 84.20; $t = 9.45$; $p < 0.05$), working memory (59.80 to 81.40; $t = 8.97$; $p < 0.05$), and cognitive flexibility (60.45 to 80.85; $t = 8.11$; $p < 0.05$). The characteristics of the game incorporating rules, turn-taking systems, and social interaction proved effective in training self-regulation, strengthening working memory, and enhancing children's cognitive flexibility. Furthermore, the integration of Islamic education perspectives contributed to character formation through the internalization of values such as discipline, patience, responsibility, and cooperation. Thus, the learning process not only impacts cognitive development but also supports children's moral and religious development in a holistic manner. Based on these findings, future research is recommended to expand the sample across diverse regional and cultural contexts to enhance the generalizability of results, to examine the long-term (longitudinal) effects of traditional game-based learning on children's executive function development, and to explore various other traditional games with potential to stimulate cognitive and character development. Additionally, it is important to investigate the relationship between early executive function development and academic achievement at subsequent educational levels in order to gain a more comprehensive understanding of the educational implications of this learning model.

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