ORIGINAL ARTICLE

Enhancing Fine Motor Skills in Early Childhood Education Programs Through Playing the Traditional Congklak Game: A Quantitative Study

Muhammad Hidayat Sahid[1,4], Akehsan Dahlan[1], Mohamad Ghazali Masuri[1], Ratna Darjanti Haryadi[2], Andriani Pratiwi[3]

[1] Centre for Occupational Therapy Studies, Faculty of Health Sciences, Universiti Teknologi MARA, Selangor Campus, 42300, Bandar Puncak Alam, Selangor, Malaysia
[2] Department of Physical Medicine and Rehabilitation, Dr Soetomo General Hospital, University of Airlangga, Indonesia, Jl. Mayjen Prof. Dr. Moestopo No.6-8, Surabaya 60286, East Java, Indonesia
[3] Occupational Therapy Department, University of Indonesia Hospital, Jl. Kesehatan Raya No.168, Kukusan, Beji, Depok, West Java 16424, Indonesia
[4] Department of Applied Health, Vocational Education Program, University of Indonesia, Jl. Prof. Dr. Sudjono D. Pusponegoro, Kukusan, Beji, Depok, West Java 16424, Indonesia

ABSTRACT

Introduction: The Traditional Congklak game, a popular activity in Indonesia, has potential benefits for enhancing fine motor skills in early childhood education. This study aims to evaluate the effectiveness of the Congklak game in improving fine motor skills among early childhood education students. **Materials and methods:** A quasi-experimental study was conducted with children from four Early Childhood Education schools in Sawangan, Depok, West Java, Indonesia. Participants underwent pretest and posttest assessments to measure fine motor skills before and after the intervention. **Results:** The analysis of pretest and posttest scores revealed a statistically significant improvement in fine motor skills following the intervention, indicating the effectiveness of the Traditional Congklak game in enhancing these skills. **Conclusion:** The findings support the integration of play-based occupational therapy principles in early childhood education, highlighting the importance of personalized approaches to skill development. Despite limitations such as a small sample size and a short intervention period, the study concludes that the Traditional Congklak game can be a valuable tool for improving fine motor skills in early childhood settings. Future research should explore the long-term effects and broader demographic contexts to enhance the generalizability of the findings.
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Keywords: Fine motor skills, Traditional game, Congklak, Early childhood education, Occupational therapy

Corresponding Author:
Muhammad Hidayat Sahid , Phd.OT
Email: m.hidayatsahid@gmail.com
Tel : +6281519527104

INTRODUCTION

The early years of childhood are essential for developing a variety of abilities, particularly fine motor skills (1,2). These skills, which require the coordination of small muscles in the hands and fingers, are important for performing daily activities and fostering overall child growth (3,4). Developing fine motor skills in early childhood was crucial as it establishes the groundwork for later academic success and personal development (5,6).

In today's rapidly advancing technological era, traditional games are increasingly being marginalized by modern technology (7–9). Digital devices and electronic games dominate children's playtime, often leading to a reduction in physical activities and hands-on play that are essential for fine motor development (8,10,11). Despite this shift, traditional games hold significant educational value and play an essential role in children's overall development. These games not only provide entertainment but also foster various physical, cognitive, and social skills (1,12,13).

One traditional game that is particularly rich in educational value is congklak (14,15). Congklak, a game deeply embedded in cultural heritage, offers more than just the joy of play (1,4). It presents an opportunity to develop children's fine motor skills through its unique gameplay mechanics (16). The game involves the movement of small seeds or stones across a wooden board, requiring precise hand-eye coordination and dexterity (17). As children manipulate the pieces, they

engage in actions that enhance their fine motor control, which is crucial for tasks such as writing, drawing, and using tools (14,18).

The game of congklak was a traditional pastime that has been played since ancient times, not only in Indonesia but also in various parts of the world (2). This game goes by different names and features various adaptations in different countries (12), yet its primary purpose remains consistent: to sharpen children's cognitive and motor abilities (19). Across the globe, congklak was embedded in cultural heritage and was a common activity for children in their communities (3,20). Particularly in the ASEAN region, congklak holds a significant place in the cultural and traditional practices (10). Countries like Malaysia, Brunei, and the Philippines each have their own versions, with unique rules and strategies (8). Despite these variations, they all aim to enhance children's cognitive and motor skills through the game (6,21).

In Indonesia, congklak is more than just a traditional game; it embodies profound cultural significance (2,17). It is woven into the fabric of daily life, especially in rural areas, where children are introduced to it at a young age, both at home and in educational settings (7). The game is used as a tool to develop fine motor skills, creativity, and cooperation among children (5). In the context of early childhood education, congklak was employed as an engaging and beneficial learning method (1). Integrating congklak into learning programs can be a proactive approach to harnessing the educational potential of this traditional game, ensuring it remains a valuable component of early childhood education (22).

Research conducted by Trisnadewi et al. has shown that using congklak in the learning process can improve students' numeracy skills and help them better understand mathematical concepts and their applications (14). Furthermore, research by Shinta et al. recommends the traditional congklak game for learning as it promotes active and enthusiastic participation, receiving positive responses and improving students' character (3). Building on these studies, this research focuses on using the traditional congklak game to develop fine motor skills in early childhood. The novelty of this research lies in utilizing the congklak game within the learning process specifically to enhance young children's fine motor skills.

Recognizing the significance of fine motor skill development at an early agewas crucial. Therefore, traditional games like congklak should be considered valuable alternatives for teaching these skills to children. Playing congklak involves physical activities that benefit children's health while also stimulating brain development and hand-eye coordination (14). Children must handle and move the game pieces with precision, which requires refined fine motor skills to place the pieces accurately. Additionally, congklak teaches cooperation, strategy, and fosters creativity. As they play, children learn to plan their moves, anticipate outcomes, and adjust their strategies based on the game's progression.

While numerous studies have explored the educational benefits of traditional games, such as Congklak, most have primarily focused on cognitive development, numeracy skills, and social interaction. However, there was a distinct gap in the literature regarding the use of Congklak specifically as a tool to enhance fine motor skills in early childhood. Existing research has emphasized modern educational approaches and the role of technology in learning, often sidelining traditional methods that could be beneficial for motor skill development.

Furthermore, although fine motor skills were critical for early academic and personal success, current educational practices often relied on structured activities such as writing exercises or standardized play. These methods may have overlooked the natural and engaging ways traditional games like Congklak could support children's motor development. Additionally, prior studies on Congklak had not thoroughly examined the intricate hand-eye coordination and precision required during gameplay and how these contributed to fine motor development.

This research aimed to close this gap by evaluating the effectiveness of Congklak in enhancing fine motor skills among young children. By integrating this traditional game into the early childhood education framework, this study sought to provide a culturally relevant, engaging, and educationally beneficial alternative to conventional fine motor skill activities. The research assessed how Congklak encouraged dexterity, coordination, and control in a way that was both enjoyable and developmentally appropriate, offering insights into how traditional games could be more widely used in educational settings.

MATERIALS AND METHODS

Research Design

The research design employed in this study was experimental in nature, aimed at determining the effectiveness of the traditional congklak game in developing fine motor skills in children. Following Arikunto's definition, experimental research sought to identify causal relationships between two variables, manipulated intentionally by the researcher, while minimizing or controlling other interfering factors to observe the effects of a specific intervention (2). A quasi-experimental research design was chosen for this study due to its ability to provide valuable insights into the cause-and-effect relationship between the intervention (Congklak) and the development of fine motor skills

in children, without the need for random assignment of participants. This design was particularly useful in educational settings, where random assignment might not have been feasible or ethical due to the need to work with existing groups of children.

Research Approach

This study utilized a pre-experimental research design with a one-group pre-test post-test approach. This method involved assessing the participants' fine motor skills before and after the intervention, allowing for a comparison of the results to determine the impact of the congklak game. Additionally, a paired t-test was conducted to statistically analyze the differences between the pre-test and post-test scores, providing a rigorous evaluation of the intervention's effectiveness.

In this study, the quasi-experimental approach allowed for the comparison of children's fine motor skills before and after participating in the Congklak game intervention. Although randomization was not utilized, the pre-test and post-test design ensured that changes in fine motor skills could be attributed to the intervention, thereby controlling for individual baseline differences.

Additionally, the choice of this method reflected the practical realities of conducting research in real-world educational environments, where assigning children to control and experimental groups might disrupt the learning process or access to beneficial activities. By using a pre-test and post-test within the same group, the study maintained ethical integrity while still providing reliable data on the intervention's effectiveness.

Participants

Sampling Technique

The study employed a purposive sampling technique, selecting participants based on predefined inclusion and exclusion criteria that aligned with the study's objectives. Children aged 4 to 6 years, enrolled in early childhood education programs, were targeted due to their critical stage of fine motor skill development. Purposive sampling ensured that the sample was appropriate and relevant to the study's goal of assessing the impact of the Congklak game on fine motor skills. Parental consent was also obtained prior to participation, ensuring that ethical considerations were met. This sampling method was chosen to focus on a population that would most likely benefit from the intervention, thus enhancing the validity of the study results.

Exclusion criteria included children younger than 4 years or older than 6 years, those not enrolled in an early childhood education program, and those whose parents or guardians did not provide signed consent for participation. Children with physical disabilities or conditions that could affect their fine motor skill performance or participation in the game, those unable to attend the majority of the congklak game sessions or assessment periods, and children who had significant prior experience playing the congklak game, which could bias the results of the study, were also excluded.

By clearly defining these inclusion and exclusion criteria, the study ensured a consistent and appropriate sample of participants, enhancing the reliability and validity of the research findings on the effectiveness of the congklak game in developing fine motor skills in young children.

Location of the Study

The research was conducted in four Early Childhood Education (PAUD) schools located in Sawangan, Depok, West Java, Indonesia. The location was selected due to its accessibility, the cooperation of the schools, and the researchers' ability to gather a sufficient number of participants who meet the inclusion criteria. This setting also offers a structured environment in which to implement and monitor the intervention, ensuring consistency in the exposure to the Congklak game across all participants.

The study followed a structured procedure to evaluate the effectiveness of the traditional congklak game in enhancing fine motor skills among young children. Initially, a pre-test was conducted where the fine motor skills of the children were assessed using the Fine Motor Skills Checklist Assessment for Preschool or Kindergarten. Following this, the intervention phase was assigned, during which the children participated in regular sessions of the congklak game over a period of four weeks. These game sessions were structured to ensure consistent exposure and engagement, with participants playing congklak every morning throughout the four-week period. After the intervention, a post-test was conducted to reassess the children's fine motor skills using the same Fine Motor Skills Checklist employed in the pre-test. Data collection occurred through direct observation and assessment of the children's fine motor skills during both the pre-test and post-test phases. (see Table I).

Table I: Children's Finemotor Skills Indicator

No	Assessment Indicators	Indicator value	Score
1	Ability to graps congklak seeds without drop it	1. Maximum assisted 2. Moderate assisted 3. Minum assisted 4. Independent	Each item is scored on a 4-point ordinal scale, ranging from a score of 1 to a score of 4. The higher the score, the better the participant is at performing the task associated with that item. 0-10 : Severe 11-20 : Moderate 21-30 : Mild 31-40 :Not apparent problem
2	Ability to place congklak seeds one by one in the congklak hole	1. Maximum assisted 2. Moderate assisted 3. Minum assisted 4. Independent	
3	Ability to coordinate their hands and eyes when playing congklak	1. Maximum assisted 2. Moderate assisted 3. Minum assisted 4. Independent	
4	Ability to use the finger tips to pick up congklak seeds	1. Maximum assisted 2. Moderate assisted 3. Minum assisted 4. Independent	
5	Ability to do cuts out simple shapes	1. Maximum assisted 2. Moderate assisted 3. Minum assisted 4. Independent	
6	Ability to do copies triangle	1. Maximum assisted 2. Moderate assisted 3. Minum assisted 4. Independent	

Data Analysis

The collected data was analyzed to determine any significant improvements in the children's fine motor skills following the intervention. Statistical methods was used to compare the pre-test and post-test results, establishing the effectiveness of the congklak game as a tool for developing fine motor skills in young children. The data analysis was conducted using SPSS version 26 to ensure precise and reliable statistical computations.

Ethical Clearance

Prior to commencing the study, ethical approval was obtained from the Ethics Review Committee with registration number 422/UN2.F10/PPM.00.03/2023. Parental consent was obtained for all participating children, and rigorous measures were taken to anonymize all collected data to safeguard confidentiality. The intervention was carefully designed to be both engaging and beneficial for the children, prioritizing their well-being throughout the duration of the study.

RESULTS

The participants in this study were drawn from four Early Childhood Education Program (ECEP) schools located in Sawangan, Depok, West Java, Indonesia (see table II). These schools were selected to represent a diverse demographic of young learners in the region. The study aimed to observe and analyze the impact of utilizing the Traditional congklak game as an educational tool within these school settings. By involving students from these institutions, the research sought to assess how the game could contribute to enhancing fine motor skills and overall learning engagement among early childhood education students in the local context.

Table II: Population Data

School	The Number of Participants
ECEP A	18
ECEP B	22
ECEP C	26
ECEP D	28

The learning outcomes of students, which include improvements in fine motor skills, reflect changes in behavior resulting from their education. These outcomes serve as a measure of achieving educational goals and allow teachers to assess the effectiveness of their teaching methods, enabling adjustments to be made during the learning process. The Traditional congklak game provides a simple yet effective tool for teachers to facilitate classroom activities. It supports the delivery of educational content and tasks, enhances students' fine motor skills, and provides a means to gauge their capabilities. Additionally, it serves as an additional resource to complement traditional teaching approaches. The results of research utilizing the Traditional congklak game have shown promising improvements in students' engagement, skill development, and overall learning outcomes.

Following the completion of the research, pretest and posttest scores were obtained to assess student performance in activities, as shown in Table III & Table IV.

The statistical data presented in Table II shows the pretest and posttest scores for four pairs of participants in the study. Each pair represents a group of participants, with their respective mean scores, standard deviations (Std Deviation), and standard errors of the mean (Std

Error Mean) for both the pretest and posttest phases. Table III provides the correlations between the pretest and posttest scores for each pair of participants. The correlation coefficient (Correlation) indicates the strength and direction of the relationship between the pretest and posttest scores. A correlation coefficient close to 1 suggests a strong positive relationship, meaning that higher pretest scores tend to correspond with higher posttest scores.

The statistical data from Tables III and IV demonstrate significant improvements in fine motor skills among participants after the intervention using the Traditional congklak game. Table 3 provides the pretest and posttest mean scores, standard deviations, and standard error means for four Early Childhood Education Programs (ECEP A, B, C, and D). For ECEP A, the pretest mean score of 25.89 increased to a posttest mean score of 36.33, with a paired samples t-test indicating significant improvement ($t = -23.500$, $df = 17$, $p < 0.001$), and a 95% confidence interval ranging from -11.382 to -9.507. ECEP B's pretest mean score of 23.64 increased to 36.36 posttest, showing significant improvement ($t = -37.804$, $df = 21$, $p < 0.001$), with a 95% confidence interval of -13.427 to -12.027. ECEP C's scores improved from a pretest mean of 25.92 to a posttest mean of 35.38, with significant results ($t = -18.368$, $df = 25$, $p < 0.001$), and a confidence interval of -10.522 to -8.401. Lastly, ECEP D's pretest mean of 25.14 increased to 36.21 posttest, with a significant t-test result ($t = -25.741$, $df = 27$, $p < 0.001$), and a confidence interval of -11.954 to -25.741. These results highlight the significant improvements in fine motor skills for all participant groups following the intervention.

Table III: Pretest-Postest Paired Samples Statistics

Participants		Mean	N	Std Deviation	Std Error Mean	t	df	Sig. (2-tailed)	95% CI	
									Lower	Upper
Pair 1 ECEP A	Pretest	25,89	18	1,875	,442	-23,500	17	0,000	-11.382	-9,507
	Posttest	36,33		1,237	,291					
Pair 2 ECEP B	Pretest	23,64	22	1,706	,364	-37,804	21	0,000	-13,427	-12,027
	Posttest	36,36		1,706	,364					
Pair 3 ECEP C	Pretest	25,92	26	1,831	,359	-18,368	25	0,000	-10,522	-8,401
	Posttest	35,38		2,872	,563					
Pair 4 ECEP D	Pretest	25,14	28	2,206	,417	-25,741	27	0,000	-11,954	-25,741
	Posttest	36,21		1,833	,346					

Table IV presents the correlations between pretest and posttest scores, indicating positive correlations for all groups, suggesting that higher pretest scores are associated with higher posttest scores. Specifically, ECEP A showed a correlation of 0.321, which was not statistically significant ($p = 0.194$). In contrast, ECEP B exhibited a significant correlation of 0.571 ($p = 0.005$), ECEP C had a significant correlation of 0.447 ($p = 0.022$), and ECEP D showed a significant correlation of 0.377 ($p = 0.048$). These significant correlations for ECEP B, C, and D indicate stronger relationships between pretest and posttest scores compared to ECEP A. Overall, the analysis confirms that the Traditional congklak game effectively enhances fine motor skills, with significant improvements and positive correlations supporting the consistency of these improvements, particularly in ECEP B, C, and D.

Table IV: Pretest-Postest Paired Samples Correlations

Participants	N	Correlation	Sig
Pair 1 ECEP A pretest & posttest	18	,321	,194
Pair 2 ECEP B pretest & posttest	22	,571	,005
Pair 3 ECEP C pretest & posttest	26	,447	,022
Pair 4 ECEP D pretest & posttest	28	,377	,048

DISCUSSION

Based on the statistical analysis results, particularly focusing on fine motor skills from an occupational therapy perspective, several key points can be discussed:

Effectiveness of the Traditional congklak Game
The variability in scores within each group, as indicated by standard deviations, highlights individual differences in response to the intervention. Occupational therapy emphasizes personalized approaches to skill development, recognizing that each child may benefit uniquely from specific interventions tailored to their needs (2,9).

The significant improvements in posttest scores across all participant pairs suggest that the intervention using the Traditional congklak game effectively enhanced fine motor skills among early childhood education students. Fine motor skills are crucial for activities such as grasping small objects, handwriting, and manipulating tools, all of which are foundational for academic and daily living tasks (16,23).

The effectiveness of the Traditional congklak game in enhancing fine motor skills, from an occupational therapy perspective,was supported by theoretical frameworks and evidence-based practices (1,2,5). Fine motor skills are essential for tasks such as manipulating small objects, handwriting, and using tools, which are foundational for academic and daily living activities (7,16).

Occupational therapy emphasizes individualized interventions tailored to each child's specific needs and abilities (6,9). The variability in scores within participant groups, as indicated by standard deviations, underscores the importance of personalized approaches in skill development. This approach aligns with evidence that interventions targeting specific motor skills can effectively enhance developmental outcomes in children (14).

Research suggests that structured play activities, like the Traditional congklak game, provide opportunities for children to practice and improve their fine motor skills in a supportive environment. Such activities are aligned with educational socio-cultural theory, which posits that play-based learning can scaffold children's development within their zone of proximal development (3).

Integrating the Traditional congklak game into educational settings not only promotes fine motor skill development but also supports broader developmental domains crucial for children's academic success and daily functioning (14).

Implications for Occupational Therapy Practice
From an occupational therapy standpoint, interventions like the traditional congklak game offered structured opportunities for students to practice fine motor tasks in a playful and engaging manner. Such activities not only supported skill acquisition but also fostered motivation and enjoyment in learning, which were crucial for sustained progress and participation in educational activities.

The use of games like congklak also aligned with evidence-based practices that highlighted the effectiveness of play-based interventions in promoting motor skill development and overall child development (2). Such activities not only targeted specific motor skills but also enhanced cognitive abilities such as problem-solving, planning, and spatial awareness (18). This holistic approach supported the comprehensive growth of children by addressing multiple developmental domains simultaneously (16,18).

Occupational therapists employed a client-centered approach, tailoring interventions to meet the unique needs and abilities of each child. The variability in responses to interventions, as indicated by standard deviations in research findings, underscored the importance of individualized therapy plans (8). By integrating activities like congklak into therapy sessions or educational settings, therapists created an environment that fostered intrinsic motivation and enjoyment in learning, which were critical for sustained engagement and progress (6).

Strength of This Study
A major strength of this study was its alignment with occupational therapy principles, emphasizing the importance of individualized interventions. The variability in scores, as demonstrated by the standard deviations, reflected the inherent diversity in how children responded to interventions . This underscored the relevance of tailoring approaches to each child’s unique needs, a central tenet of occupational therapy that ensured maximum benefits for each participant (3,20).

The intervention was grounded in established occupational therapy frameworks and evidence-based practices that validated the use of structured play activities in fostering motor skill development. These frameworks emphasized not only the motor benefits but also the broader impact on cognitive abilities, including problem-solving and planning skills, which were integral to child development (8).

The use of congklak aligned with socio-cultural learning theory, which suggested that structured, playful activities could significantly enhance children's fine motor skills. These activities allowed children to practice within their zone of proximal development, which contributed to both motor and cognitive growth. This highlighted the holistic nature of the intervention, targeting multiple developmental domains at once, a strength that was crucial for comprehensive child development (16,18.

Furthermore, incorporating games into therapy not only facilitates skill acquisition but also promotes social interaction and cooperation among children. These social skills are essential for developing meaningful relationships and navigating social contexts both in school and beyond (13,24).

Limitation of the study
Several limitations were identified in this study. The study was conducted with a specific group of early childhood education students from a limited geographic area, which may restrict the generalizability of the findings to broader populations or different educational settings. The duration of the intervention using the Traditional congklak game may have been relatively short. Longer-term studies could provide insights into the sustainability of the observed improvements in fine motor skills. The reliance on pretest and posttest scores as the primary measurement tool may not capture the full spectrum of developmental changes or the qualitative aspects of children's experiences with the intervention. Despite efforts to anonymize data and ensure confidentiality,

there may still be inherent biases or influences that could affect the results, such as teacher or observer biases in assessing outcomes. External factors, such as other educational interventions or variations in individual learning environments, were not fully controlled for and could potentially influence the outcomes observed.

CONCLUSION

The effectiveness of the traditional congklak game in enhancing fine motor skills among early childhood education students was well-supported by both theoretical frameworks and empirical evidence. The significant improvements observed in post-test scores across all participant pairs highlighted the game's ability to effectively promote fine motor skill development. These skills were fundamental for tasks crucial to academic success and daily living, such as handwriting and tool manipulation. From an occupational therapy perspective, the variability in scores within participant groups underscored the importance of personalized interventions tailored to meet each child's unique needs. Furthermore, integrating structured play activities into educational settings not only supported skill acquisition but also enhanced motivation and engagement in learning. By creating an environment that encouraged intrinsic motivation and enjoyment, therapists and educators facilitated sustained progress and participation in educational activities.

In summary, the traditional congklak game represented a valuable tool in occupational therapy and educational practices, offering meaningful opportunities for children to develop essential motor skills within a supportive and enjoyable context. Its integration aligned with best practices in promoting holistic child development and prepared children for success both academically and in daily activities.

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