Enhancing ADHD Intervention Through Dakon: A Sustainable Occupational Therapy Innovation Rooted in Indonesian Cultural Practices

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Abstract.

Background: Children with Attention-Deficit/Hyperactivity Disorder (ADHD) often experience difficulties in attention, behavioral regulation, motor coordination, and social participation. Culturally relevant occupational therapy interventions may improve engagement while supporting sustainable healthcare. Dakon, a traditional Indonesian board game, integrates cognitive, motor, behavioral, and social demands, making it a potential therapeutic medium. **Objective:** This study investigated differences in Dakon gameplay performance between children with ADHD and typically developing children to explore its potential in occupational therapy.**Methods:** A comparative observational study included 20 children aged 6–11 years (10 ADHD; 10 typically developing). Participants were observed during Dakon gameplay across five domains: cognitive engagement, behavioral regulation, fine and gross motor skills, social interaction, and game strategy understanding. Group differences were analyzed using the Mann–Whitney U test. **Results:** Children with ADHD performed significantly lower than typically developing children across all domains ($p < 0.001$). The greatest deficit was found in game strategy understanding (47% lower), followed by social interaction (45%), cognitive engagement (43%), fine and gross motor skills (43%), and behavioral regulation (39%). These findings suggest that Dakon effectively elicits executive functioning, motor coordination, self-regulation, and social participation within a meaningful cultural context. **Conclusion:** Dakon is a promising low-cost, culturally responsive occupational therapy medium that supports sustainable pediatric rehabilitation. Further experimental studies are needed to establish its therapeutic effectiveness and long-term outcomes.

Keywords: ADHD; Occupational Therapy; Cultural-Based Intervention; Traditional Games; Pediatric Rehabilitation.

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1. Introduction

Children with Attention-Deficit/Hyperactivity Disorder commonly experience challenges in sustaining attention, regulating behavior, coordinating motor movements, and engaging effectively in social interactions [1]. These difficulties often affect their participation in structured activities, including educational and therapeutic interventions [2]. Conventional intervention approaches may not always reflect children's sociocultural backgrounds, limiting engagement and long-term sustainability in therapy programs [3]. Therefore, culturally contextualized and accessible therapeutic approaches are increasingly important in promoting sustainable healthcare innovation [4].

Traditional games have recently gained attention as culturally meaningful intervention tools because they integrate cognitive, motor, behavioral, and social components simultaneously [3]. One Indonesian traditional game that has potential therapeutic value is *Dakon*, a board game involving strategic thinking, turn-taking, hand coordination, and sustained attention [4]. The game requires players to manipulate stones using repetitive finger movements while maintaining concentration and social interaction with peers [5]. These characteristics align closely with therapeutic goals in Occupational Therapy for children with ADHD [6].

This study explores the use of Dakon as a culturally relevant and sustainable occupational therapy medium for children with ADHD. The novelty of this research lies in integrating indigenous play-based practices into pediatric occupational therapy within the framework of sustainable healthcare innovation. Specifically, the study aims to dentify differences in gameplay performance between typically developing children and children with ADHD during Dakon gameplay and also to identify the challenges and difficulties experienced by children with ADHD while playing Dakon.

2. Materials and Methods

This study employed an observational comparative design involving 20 children aged 6–11 years. Participants consisted of two groups: 10 children diagnosed with ADHD recruited from the pediatric occupational therapy unit of Universitas Indonesia Hospital and 10 typically developing children recruited from Pioneer Elementary School. Purposive sampling was used to ensure variation by diagnosis while maintaining comparable age distribution between groups.

Participants were observed while playing Dakon. The observational assessment focused on five primary domains: (1) Cognitive Engagement, (2) Behavioral Regulation, (3) Fine and Gross Motor Skills, (4) Social Interaction, and (5) Game Strategy Understanding

Each domain included several subcomponents, such as focus on gameplay, turn-taking compliance, manipulation of stones, cooperation with peers, and ability to

plan strategic moves. Data were analyzed using descriptive statistics and inferential analysis. Since normality assumptions were violated based on Shapiro–Wilk test results, the Mann–Whitney U test was applied to compare differences between groups.

3. Results

3.1 Demographic Characteristics of Participants

A total of 20 children aged 6–11 years participated in this study, consisting of 10 children diagnosed with ADHD and 10 typically developing children. Participants were grouped based on diagnosis while maintaining comparable age representation across groups. The ADHD group was recruited from the pediatric occupational therapy unit at Universitas Indonesia Hospital, while the typical group was recruited from Pioneer Elementary School.

Table 1. Distribution of Participants by Age and Gender

Age (Years)	Typical Boys	ADHD Boys	Typical Girls	ADHD Girls
6	1	0	0	1
7	1	1	0	1
8	0	2	2	1
9	0	1	2	1
10	2	2	1	0
11	0	0	1	0
Total	**4**	**6**	**6**	**4**

The demographic distribution indicates relatively balanced representation across the age range. Boys were more prevalent in the ADHD group, while girls were more represented in the typically developing group. Despite slight differences in clustering across age categories, both groups demonstrated comparable developmental representation suitable for observational comparison.

3.2 Normality Testing

Prior to inferential analysis, the Shapiro–Wilk test was conducted to determine whether data distributions met assumptions of normality. The results showed that several variables significantly deviated from normal distribution ($p < 0.05$), particularly in subdomains related to behavioral regulation, social interaction, and motor coordination. Therefore, non-parametric analysis using the Mann–Whitney U test was applied.

Table 2. Summary of Shapiro–Wilk Normality Test Results

Domain	Typical Group (p-value)	ADHD Group (p-value)	Interpretation
Cognitive Engagement	0.17	0.07	Approximately Normal
Behavioral Regulation	0.12	0.01	ADHD Non-Normal
Fine & Gross Motor Skills	0.00	0.22	Typical Non-Normal
Social Interaction	0.01	0.01	Non-Normal
Game Strategy Understanding	0.07	0.07	Approximately Normal

The findings indicate that normality assumptions were not consistently satisfied across all domains. Consequently, the Mann–Whitney U test was considered the most appropriate statistical procedure for comparing group performance.

3.3 Differences in Performance Between Typical Children and Children with ADHD

The Mann–Whitney U analysis demonstrated statistically significant differences between the two groups across all measured domains ($p < 0.001$). Typically developing children consistently outperformed children with ADHD in cognitive engagement, behavioral regulation, motor coordination, social interaction, and strategic understanding during Dakon gameplay.

Table 3. Median Scores Across Gameplay Domains

Domain	Typical Children Median	ADHD Children Median	Difference	% Lower in ADHD
Cognitive Engagement	28.00	16.00	12.00	43%
Behavioral Regulation	28.00	17.00	11.00	39%
Fine & Gross Motor Skills	40.00	23.00	17.00	43%
Social Interaction	28.00	15.50	12.50	45%
Game Strategy Understanding	25.50	13.50	12.00	47%

Children with ADHD showed substantial performance reductions in all domains. The largest difference was observed in game strategy understanding, where ADHD participants scored 47% lower than their typically developing peers. Significant deficits were also observed in social interaction and cognitive engagement.

3.4 Cognitive Engagement Performance

Cognitive engagement refers to the child's ability to sustain attention, remain focused on gameplay, and demonstrate interest in strategic elements of Dakon. Typical children achieved consistently higher scores across all cognitive indicators.

Table 4. Cognitive Engagement Comparison

Component	Typical Median	ADHD Median	Z-value	p-value
Focus on Gameplay	9.00	6.00	-3.85	0.00
Duration of Attention	9.00	5.00	-3.86	0.00
Interest in Strategy	9.00	5.00	-3.86	0.00
Total Score	**28.00**	**16.00**	**-3.82**	**0.00**

The findings indicate that children with ADHD had greater difficulty maintaining sustained attention and cognitive involvement during gameplay activities. These challenges align with executive functioning impairments commonly associated with ADHD.

3.5 Fine and Gross Motor Skills Performance

Fine and gross motor coordination emerged as one of the most distinct areas of difference between groups. Dakon gameplay requires repetitive finger dexterity, coordinated hand movements, and postural control. Children with ADHD demonstrated lower precision and movement smoothness compared to typical children.

Table 5. Fine and Gross Motor Skills Comparison

Component	Typical Median	ADHD Median	Z-value	p-value
Manipulating Stones	10.00	6.00	-3.98	0.00
Smoothness of Movement	10.00	5.50	-3.97	0.00
Precision in Placing Stones	10.00	5.00	-3.97	0.00
Stable Posture During Gameplay	10.00	6.00	-4.08	0.00
Total Score	**40.00**	**23.00**	**-3.97**	**0.00**

These results demonstrate that Dakon may function not only as a recreational activity but also as a therapeutic medium for assessing and training finger dexterity, bilateral coordination, and motor planning in pediatric occupational therapy settings.

3.6 Social Interaction and Behavioral Regulation

Children with ADHD also demonstrated lower social adaptability and behavioral regulation during gameplay. Difficulties were observed in turn-taking, emotional regulation, cooperation, and frustration management.

Table 6. Social Interaction and Behavioral Regulation Comparison

Domain Component	Typical Median	ADHD Median	p-value
Turn-taking Compliance	9.00	6.00	0.00

Verbal Communication	10.00	6.00	0.00
Appropriate Game Language	9.00	5.00	0.00
Cooperation with Peers	10.00	6.00	0.00
Handling Frustration	9.00	4.50	0.00

These findings suggest that Dakon gameplay naturally stimulates opportunities for practicing self-regulation, social communication, and peer interaction skills. From an occupational therapy perspective, culturally familiar games may increase participation and motivation compared to conventional clinical activities.

4. Discussion

The present study contributes to the growing discourse on culturally responsive and sustainable pediatric rehabilitation by demonstrating the therapeutic potential of *Dakon*, an Indonesian traditional game, as an intervention medium for children with Attention-Deficit/Hyperactivity Disorder. The findings revealed consistent and statistically significant differences between typically developing children and children with ADHD across all assessed domains, including cognitive engagement, behavioral regulation, motor coordination, social interaction, and game strategy understanding. These findings not only reinforce existing neurodevelopmental literature regarding ADHD-related executive dysfunction but also extend current occupational therapy research by positioning traditional gameplay as a multidimensional therapeutic occupation.

From a neurocognitive perspective, the lower performance observed among children with ADHD in sustained attention, turn-taking compliance, and strategic planning reflects impairments in executive functioning processes governed primarily by frontostriatal and prefrontal neural networks [7], [8], [9]. Executive functions such as inhibitory control, working memory, cognitive flexibility, and sustained attention are critical for structured gameplay participation [2], [3], [10]. Dakon inherently requires children to continuously monitor stone distribution, anticipate future consequences of moves, inhibit impulsive responses, and maintain attention over repeated turns [5], [6], [11]. Therefore, the significant differences observed in cognitive engagement and game strategy understanding suggest that Dakon may serve as a naturalistic ecological assessment medium capable of revealing executive functioning deficits in a contextually meaningful activity rather than through isolated clinical tasks.

The motor performance findings are equally important within the context of pediatric occupational therapy. Children with ADHD demonstrated lower scores in manipulating stones, movement precision, movement smoothness, and postural stability [6], [7], [12]. These findings align with prior evidence indicating that children with ADHD frequently exhibit developmental coordination difficulties, fine motor impairments, and reduced motor planning abilities [13], [14], [15]. Dakon gameplay requires repetitive pincer grasp patterns, bilateral hand coordination, visual-motor integration, and graded motor control, all of which are foundational components of fine motor de-

velopment [8], [16], [17]. Unlike repetitive therapeutic drills that may reduce child engagement, Dakon embeds motor practice within an intrinsically motivating social activity [13], [17], [18]. Consequently, the game may support principles of neuroplasticity through repeated meaningful occupation, which is central to contemporary occupational therapy intervention paradigms [19], [20], [21].

The social interaction findings further highlight the multidimensional therapeutic value of Dakon [7], [19]. Children with ADHD exhibited greater difficulty managing frustration, responding appropriately to winning and losing situations, and cooperating with peers during gameplay [22], [23], [24]. These observations are consistent with social participation challenges frequently experienced by children with ADHD, particularly in peer-mediated contexts requiring emotional regulation and reciprocal communication [1], [3], [23]. Importantly, Dakon creates a naturally occurring social environment in which children must negotiate rules, interpret social cues, and regulate emotional responses in real time. Such interactional demands provide opportunities for therapeutic social learning that may not emerge within highly structured or clinician-directed interventions [1], [6], [7], [15].

Beyond individual performance outcomes, the findings may also be interpreted through the lens of the Person-Environment-Occupation-Performance (PEOP) model [19], [20], [25]. The PEOP model emphasizes that occupational performance emerges through dynamic interaction between personal capacities, environmental contexts, and meaningful occupations [26], [27], [28]. In this study, Dakon functions not merely as a recreational tool but as a culturally embedded occupation that facilitates therapeutic engagement through contextual relevance. The environmental familiarity associated with traditional Indonesian gameplay may reduce performance anxiety and improve intrinsic motivation compared to unfamiliar clinical exercises. This is particularly relevant for children with ADHD, whose participation is often highly influenced by motivational salience and environmental stimulation [1], [6], [17].

The cultural dimension of this study represents a significant theoretical and practical contribution [15]. Contemporary pediatric rehabilitation increasingly advocates for culturally responsive interventions that acknowledge local identity, traditions, and community participation [17], [29]. However, many therapeutic tools used in occupational therapy remain heavily influenced by Western clinical models and commercially produced intervention materials [19]. Dakon offers an alternative framework in which indigenous knowledge systems and cultural heritage become integrated into healthcare innovation. In this sense, the therapeutic use of Dakon extends beyond rehabilitation outcomes alone; it simultaneously contributes to cultural preservation, intergenerational knowledge transmission, and community engagement. This aligns closely with sustainable healthcare principles emphasizing accessibility, affordability, cultural continuity, and long-term community applicability [19].

Furthermore, the findings support broader discussions surrounding sustainable and inclusive healthcare innovation in low and middle-income countries. Technology-

based interventions for ADHD often require substantial financial resources, digital infrastructure, and specialized equipment, limiting accessibility in many communities [21]. In contrast, Dakon represents a low-cost, environmentally sustainable, and easily replicable intervention medium that can be implemented in schools, therapy clinics, and home environments without extensive technological dependence [19], [21]. The integration of traditional games into rehabilitation practice may therefore reduce disparities in access to therapeutic resources while promoting locally grounded healthcare solutions [17].

Another important implication concerns occupational justice and participation equity. Children with ADHD frequently experience occupational deprivation due to behavioral stigma, reduced peer acceptance, and limited opportunities for successful participation in structured activities [7]. By using culturally familiar play occupations such as Dakon, therapists may create more inclusive participation contexts that support competence, belonging, and positive self-efficacy [2], [22]. In this regard, Dakon may function not only as a therapeutic modality but also as a socially inclusive occupation capable of strengthening identity formation and participation rights among neurodiverse children [7], [11].

Nevertheless, several limitations should be acknowledged. The observational nature of this study limits causal interpretation regarding therapeutic effectiveness. Additionally, the relatively small sample size may reduce generalizability across broader populations. The study also focused primarily on short-term gameplay observation without evaluating longitudinal therapeutic outcomes. Future research should therefore employ experimental or longitudinal designs to examine the effectiveness of Dakon-based occupational therapy interventions over time. Further studies may also investigate physiological regulation, sensory processing, executive functioning outcomes, and participation-based quality of life measures associated with traditional game interventions.

Overall, this study demonstrates that Dakon possesses substantial potential as a culturally contextualized therapeutic occupation capable of addressing cognitive, motor, behavioral, and social challenges among children with ADHD. The integration of indigenous play into occupational therapy practice represents an innovative convergence of rehabilitation science, cultural sustainability, and community-based healthcare development.

5. Conclusion

This study demonstrated significant differences in gameplay performance between typically developing children and children with Attention-Deficit/Hyperactivity Disorder during *Dakon* gameplay across multiple developmental domains, including cognitive engagement, behavioral regulation, fine and gross motor skills, social interaction, and game strategy understanding [2], [10], [17]. Children with ADHD consist-

ently exhibited lower performance in sustaining attention, regulating behavior, coordinating motor movements, managing social interaction, and applying strategic thinking during gameplay activities. These findings reinforce existing evidence that ADHD affects not only attentional processes but also broader occupational performance components that influence participation in meaningful daily activities [11], [17], [22].

Importantly, the findings suggest that Dakon possesses considerable potential as a culturally contextualized therapeutic medium within Occupational Therapy practice. As a traditional Indonesian game, Dakon integrates cognitive, motor, social, and behavioral demands simultaneously within a meaningful and familiar activity context. The use of Dakon therefore represents an innovative form of sustainable healthcare intervention that is low-cost, accessible, environmentally sustainable, and culturally relevant. Beyond its therapeutic function, the integration of Dakon into intervention programs may also contribute to preserving cultural heritage and promoting inclusive participation for neurodiverse children within community settings [17], [19], [29].

This study also highlights the importance of integrating indigenous play occupations into rehabilitation practice through culturally responsive and occupation-based approaches. The findings support the relevance of the Person-Environment-Occupation-Performance (PEOP) framework, emphasizing that meaningful occupational engagement is strongly influenced by contextual and cultural factors [30]. By embedding therapy within culturally familiar activities, practitioners may improve motivation, participation, and long-term intervention sustainability among children with ADHD.

Nevertheless, several limitations should be acknowledged. First, the study involved a relatively small sample size, which may limit the generalizability of the findings to broader populations. Second, the observational and cross-sectional design restricts causal interpretation regarding the therapeutic effectiveness of Dakon-based interventions over time. Third, the study primarily focused on gameplay performance and did not assess long-term developmental outcomes, sensory regulation, or academic participation.

Future studies are therefore recommended to employ experimental and longitudinal research designs involving larger and more diverse participant groups. Further investigation should examine the long-term therapeutic effects of Dakon-based occupational therapy interventions on executive functioning, sensory processing, emotional regulation, participation outcomes, and quality of life among children with ADHD. Comparative studies involving digital therapeutic games and traditional play interventions may also provide deeper insight into the role of culturally grounded occupations in sustainable pediatric rehabilitation practices.

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