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Effects of Modified Board Game–Based Cognitive Stimulation on Cognitive Function in Community-Dwelling Older Adults: an Occupational Therapy Intervention Study

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Abstract: Cognitive decline is a common condition among older adults that may affect memory, attention, and functional independence. Non-pharmacological interventions, particularly activity-based approaches, are increasingly recommended to maintain cognitive function. Board game–based cognitive stimulation has emerged as a promising, engaging, and accessible intervention within occupational therapy practice. This study aimed to examine the effect of a modified board game–based cognitive stimulation program on cognitive function among community-dwelling older adults. This study employed a quantitative pre-experimental design using a one-group pretest–posttest approach. A total of 50 pre-elderly and older adults were recruited using purposive sampling based on predetermined inclusion criteria. Cognitive function was measured using the Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina) before and after the intervention. The intervention consisted of a modified board game program conducted over eight sessions, each lasting 30–60 minutes, integrating cognitive tasks across multiple domains. Data were analyzed using descriptive statistics and paired sample t-test with a significance level of $p < 0.05$. The findings showed a statistically significant improvement in cognitive function after the intervention ($p = 0.000$, $p < 0.05$). Participants demonstrated increased scores across multiple cognitive domains following the modified board game–based cognitive stimulation program. The modified board game–based intervention was effective in improving cognitive function among community-dwelling older adults. This approach offers a practical, low-cost, and engaging strategy that can be implemented in community and occupational therapy settings to support cognitive health and functional independence in aging populations.

Keywords: Board game; Cognitive stimulation; Community; Therapy

Introduction

Population aging is associated with a progressive decline in cognitive function, particularly in domains such as memory, attention, processing speed, and executive functioning. Although these changes are often considered part of normal aging, they may progress into mild cognitive impairment (MCI) or dementia if not properly addressed. Cognitive decline is commonly manifested as difficulty in forming new memories and slower responses to both simple and complex stimuli, with variability influenced by biological and environmental factors (Jaroudi et al., 2017).

Cognitive impairment affects not only memory but also multiple domains such as orientation, language, and executive function (Traykov et al., 2007). These impairments significantly impact an individual's ability to perform activities of daily living (ADL), maintain social participation, and sustain independence. From an occupational therapy perspective, cognitive function is fundamental for successful engagement in meaningful occupations. Declining cognitive capacity is therefore closely associated with reduced functional performance

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and decreased quality of life among older adults (Vásquez-Carrasco et al., 2025).

The prevalence of cognitive decline among community-dwelling older adults continues to increase and represents a major public health concern (Pais et al., 2020). Evidence indicates that without appropriate intervention, cognitive decline may lead to reduced independence, social withdrawal, and increased risk of dementia. Furthermore, approximately 10% of individuals with mild cognitive impairment progress to dementia each year, highlighting the importance of early preventive strategies (Stephen et al., 2021).

Non-pharmacological interventions have been widely explored to address cognitive decline, including cognitive training, physical exercise, and cognitively stimulating leisure activities. Recent evidence suggests that leisure-based interventions—such as games and interactive activities—can significantly improve cognitive performance, including memory, executive function, and overall quality of life in older adults (Lv et al., 2025).

Among these approaches, board games have gained increasing attention as accessible, low-cost, and socially engaging cognitive interventions. Board games inherently involve problem-solving, memory recall, attention, and decision-making processes, making them suitable tools for cognitive stimulation. A systematic review and meta-analysis reported that traditional board games significantly improve global cognitive function, as measured by instruments such as the Montreal Cognitive Assessment (MoCA) and Mini-Mental State Examination (MMSE), and may contribute to slowing cognitive decline in older adults (P.-J. Chen et al., 2022; Guardabassi et al., 2025).

In addition, randomized controlled trials have demonstrated that structured board game interventions can enhance executive function and quality of life in the elderly, supporting their effectiveness as therapeutic modalities within rehabilitation settings (Herrero et al., 2025).

One of the most widely known and adaptable board games is bingo. Traditionally, bingo is a number-based game requiring players to match randomly called numbers with those displayed on a grid, typically arranged in a 5×5 matrix. This activity engages multiple cognitive domains simultaneously, including sustained attention, visual scanning, working memory, and processing speed. Engagement in such cognitively stimulating activities has been associated with better memory, attention, and processing speed in older adults, particularly those at risk of cognitive impairment (Malito, 2024).

In this study, a modified bingo-based cognitive stimulation program was developed as an occupational therapy intervention. Unlike conventional bingo, this modified version integrates structured cognitive tasks adapted from the Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina), covering domains such as visuospatial ability, naming, memory, attention, language, abstraction, delayed recall, and orientation. Participants are required to correctly answer cognitive questions in order to mark corresponding numbers on their bingo cards, thereby combining cognitive training with meaningful and engaging activity (Llorente et al., 2024).

This approach aligns with the core principles of occupational therapy, emphasizing participation in purposeful, client-centered, and contextually relevant activities. Embedding cognitive challenges within a familiar and enjoyable game format may enhance motivation, adherence, and therapeutic outcomes (Ambros-Antemate et al., 2023).

Therefore, this study aims to examine the effects of a modified bingo-based cognitive stimulation intervention on cognitive function among community-dwelling older adults. It is expected that this intervention can provide an innovative, practical, and evidence-based strategy to support cognitive health and functional independence in the aging population.

Method

This study employed a quantitative approach using a pre-experimental design with a one-group pretest–posttest format to examine the effect of a modified bingo-based cognitive stimulation intervention on cognitive function. The study population consisted of 50 pre-elderly and older adults from a community elderly group in Kemiri Village, Kebakkramat, Karanganyar, Indonesia. Participants were selected using purposive sampling based on the following inclusion criteria: aged over 45 years, having a minimum score of 10 on the Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina), able to read and recognize numbers, willing to participate in eight intervention sessions, and providing informed consent.

The intervention was delivered over eight sessions, each lasting 30–60 minutes, using a modified bingo game designed as a cognitive stimulation activity. In this intervention, participants were required to match randomly called numbers with those on their bingo cards and answer cognitive questions adapted from MoCA-Ina domains, including visuospatial ability, memory, attention, language, abstraction, delayed recall, and orientation. Participants could mark their bingo cards only after providing correct answers, thereby integrating structured cognitive training into an

engaging and meaningful activity consistent with occupational therapy principles.

Cognitive function was measured using the Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina) (Bahrudin et al., 2022), a validated screening tool assessing multiple cognitive domains with scores ranging from 0 to 30, where higher scores indicate better cognitive function. A score below 26 indicates cognitive impairment, with an additional point added for participants with 12 years of education or less. Data collection was conducted through direct assessment before and after the intervention, supported by demographic data obtained through interviews and secondary data from community records.

Data were analyzed using SPSS software. Descriptive statistics were used to summarize participant characteristics and cognitive scores. The normality of the data was assessed using the Shapiro–Wilk test. If the data were normally distributed ($p > 0.05$), a paired sample t-test was used to compare pretest and posttest scores. If the data were not normally distributed ($p < 0.05$), the Wilcoxon signed-rank test was applied. Statistical significance was set at $p < 0.05$.

Result and Discussion

The intervention was carried out at community RW 008 Kemiri Village Kebakkramat, Karanganyar for 10 months. The sample of the study was 50 people with a percentage of 50.5% young old, 100 % women, 71.4 % basic education level.

Table 1. MoCA-Ina *pretest-posttest*

Parameters	N	Mean	Std. dev
Pre Test	50	22.9	3.88
Post Test	50	25.12	2.42

Table 1 shows the change in scores between the pre-test and post-test. The change in pre-test scores ranged from 13 as the lowest score to 29 as the highest. Meanwhile, post-test scores ranged from 20 as the lowest score to 30 as the highest score. Overall, post-test scores were higher than pre-test scores. The largest difference in score change was 7 points, while the smallest difference was 0 points.

Table 2. Normality test

Parameters	N	ρ value
Pre-test MoCA-Ina	50	0.191
Post-test MoCA-Ina	50	0.600

Table 2 shows that the probability value (p-value) for the pre-test score was 0.191 and the post-test score was 0.600 using MoCA-Ina, meaning the values are >0.05, thus indicating that the data in this study are normally distributed.

Table 3. Hypothesis result

Parameters	Mean (Std.dev)	Δ (Std.dev)	Interval conf 95%	Sig
Pre- test	22.90 (3.88)	2.22 (1.61)	-2.718 – 1.711	0.000
Pre- test	25.12 (2.42)			

Based on table, it can be seen that after the intervention, the results of the pretest and posttest p value = 0.000 ($p < 0.05$). This shows that there is an effect of modified board game–based cognitive stimulation on cognitive function in community-dwelling older adults.

The findings of this study demonstrated that the modified board game–based cognitive stimulation intervention had a statistically significant effect on improving cognitive function among community-dwelling older adults. The paired sample t-test showed a significant difference between pretest and posttest scores ($p < 0.05$), indicating that the intervention was effective in enhancing cognitive performance. These results support the growing body of evidence that non-pharmacological, activity-based interventions can play a crucial role in maintaining and improving cognitive health in aging populations.

Board games are increasingly recognized as effective tools for cognitive stimulation because they engage multiple cognitive domains simultaneously, including attention, memory, executive function, and problem-solving (Cès et al., 2024; Martinez et al., 2023; Vita-Barrull et al., 2022). Recent studies have shown that participation in cognitively stimulating leisure activities, such as board games, is associated with improved global cognitive function and may help delay cognitive decline in older adults (Noda et al., 2019; Pozzi et al., 2023). These activities require active mental engagement, rapid information processing, and decision-making, which are essential components of cognitive functioning.

The present study utilized a modified board game intervention that incorporated structured cognitive tasks adapted from the Montreal Cognitive Assessment (MoCA-Ina). This modification allowed participants not only to engage in the game but also to actively perform cognitive exercises targeting domains such as visuospatial ability, memory, attention, language, abstraction, delayed recall, and orientation. Previous research has indicated that multidomain cognitive interventions are more effective than single-domain approaches because they stimulate broader neural networks and promote cognitive resilience (Bahar-Fuchs et al., 2013; Livingston et al., 2020).

The mechanism underlying the effectiveness of this intervention can be explained through cognitive stimulation theory, which suggests that repeated engagement in mentally stimulating activities enhances neuroplasticity and supports cognitive reserve. Activities that combine cognitive challenges with meaningful engagement, such as board games, can improve both cognitive performance and emotional well-being (Kueider et al., 2012). In this study, participants were required to focus on the game, recall information, and respond accurately to cognitive questions, thereby training attention, working memory, and executive control simultaneously.

In addition, the social interaction embedded in the group-based board game sessions may have contributed to the observed improvements in cognitive function. Social engagement has been shown to be a protective factor against cognitive decline, as it enhances emotional support, reduces stress, and stimulates cognitive processing through communication and collaboration (Piolatto et al., 2022; Puspitosari & Nurhidayah, 2025). Participants in this study interacted, discussed, and supported each other during the sessions, which likely enhanced both motivation and cognitive engagement.

The frequency and duration of the intervention may also have influenced the outcomes. This study implemented eight sessions of intervention with a duration of 30–60 minutes per session, which is consistent with previous findings indicating that regular and repeated cognitive stimulation is necessary to achieve meaningful improvements (Y. Chen et al., 2024). Consistency and adherence to cognitively stimulating activities are key factors in maximizing their benefits for cognitive health.

Furthermore, the modification of the board game mechanics played an important role in increasing the cognitive demands of the activity. By requiring participants to correctly answer cognitive questions before completing game tasks, the intervention shifted from a passive recreational activity to an active cognitive training process. This approach aligns with occupational therapy principles, emphasizing purposeful, meaningful, and client-centered activities that promote both cognitive and functional outcomes.

Despite these promising findings, this study has several limitations. The use of a one-group pretest–posttest design without a control group limits the ability to attribute causality solely to the intervention. Additionally, the sample size was relatively small and drawn from a single community, which may limit generalizability (Ahmed, 2024; Corso et al., 2024; Puspitosari & Putri, 2024; Raifman et al., 2022). Future studies are recommended to use randomized controlled designs with larger and more diverse populations to strengthen the evidence base.

Overall, this study highlights the potential of modified board game–based interventions as an accessible, low-cost, and engaging strategy to improve cognitive function in older adults. Integrating cognitive stimulation into enjoyable and socially interactive activities may enhance adherence and provide sustainable benefits for cognitive health and functional independence.

Conclusion

The modified board game–based cognitive stimulation program significantly improved cognitive function among community-dwelling older adults. This intervention represents an effective, low-cost, and engaging occupational therapy approach to support cognitive health and promote functional independence in aging populations.

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Author Contributions

Conceptualization, Aniek Puspitosari and Ninik Nurhidayah.; methodology, Aniek Puspitosari.; software, Aniek Puspitosari.; validation, Aniek Puspitosari, and Ninik Nurhidayah.; formal analysis, Aniek Puspitosari.; investigation, Aniek Puspitosari.; resources, Aniek Puspitosari.; data curation, Aniek Puspitosari.; writing—original draft preparation, Aniek Puspitosari.; writing—review and editing, Aniek Puspitosari.; visualization, Aniek Puspitosari.; supervision, Aniek Puspitosari.; project administration, Aniek Puspitosari.; funding acquisition, Ninik Nurhidayah. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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