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Development of Monopoly Mitigation Game (Momi) to Improve Critical Thinking Skills of Early Childhood

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ABSTRACT

This research aims to develop and test the effectiveness of the Monopoly Mitigation Game (MOMI) in enhancing critical thinking skills of children aged 5–6 years in the context of earthquake disaster mitigation. The study adopts a research and development design using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The research was conducted with 21 children from TK ABA 27 Sedayulawas in Lamongan, East Java. The instruments included observation sheets and validation questionnaires. Results showed that the material expert validation scored 87.5% and media expert validation scored 85%, both categorized as "very feasible." Practicality and effectiveness scores reached 82.8%, categorized as "very practical and effective." The Wilcoxon test yielded a significance value of 0.000 (<0.05), and the N-Gain average improvement score was 66.7%, indicating a high category. These findings confirm that MOMI is valid, practical, and effective in

fostering children's critical thinking and awareness of disaster risk reduction.

Introduction

Disaster risk education in early childhood is essential in Indonesia, which is geologically prone to natural disasters such as earthquakes. Critical thinking is one of the key competencies for children in recognizing and responding to disaster situations. Research indicates that children aged 5–6 years are in the preoperational cognitive stage (Piaget in Ibda, 2015), where learning is most effective through active, engaging media such as games (Camilla & Ningrum, 2023). However, observational data from TK ABA 27 Sedayulawas reveals that many children still struggle with basic critical thinking, especially in responding to earthquake-related scenarios.

Prior studies have shown that games like "MOTANA" (Mega Monopoly Disaster Game) can foster cognitive and social skills. However, these games often involve multiple disaster types and group collaboration, which may not effectively develop individual problem-solving skills. This study proposes the MOMI game as an innovation that focuses specifically on earthquake mitigation and targets the development of individual critical thinking, using a single disaster context to avoid cognitive overload (Khusna et al., 2023).

Another previous studies explored the development of disaster mitigation learning models for early childhood education, primarily focusing on improving children's preparedness, knowledge, and

adaptive behaviors through play-based and contextual learning approaches. However, their focus, learning outcomes, and pedagogical orientations differ from the proposed Monopoly Mitigation Game (Momi), particularly in relation to critical thinking skills.

Pranoto et al. (2023) developed a disaster mitigation learning program for kindergarten students through physical fun games addressing various natural disasters such as earthquakes, floods, and tsunamis. The study demonstrated that play-based physical activities significantly enhanced children's knowledge of disaster preparedness and self-rescue actions. The strength of this study lies in its comprehensive validation process and its emphasis on experiential learning through bodily engagement. Nevertheless, the learning outcomes were largely knowledge- and skill-oriented, concentrating on emergency responses and procedural understanding. The study did not explicitly target or measure higher-order cognitive abilities such as critical thinking, nor did it employ structured game mechanics that encourage reasoning, decision-making, or problem-solving.

Similarly, Cinantya et al. (2021) developed a flood disaster mitigation learning model tailored to early childhood characteristics. Their findings showed that the model was valid, effective, and practical in introducing scientific concepts and environmental awareness among children aged 4–6 years. The novelty of this study lies in its developmental appropriateness and alignment with children's cognitive stages. However, the model was implemented mainly through

lesson plans and instructional strategies rather than interactive educational games, and the evaluation focused on effectiveness and practicality rather than cognitive processes such as analysis, evaluation, or strategic thinking.

Rahmaniah (2023) addressed fire disaster mitigation in early childhood education by developing a simulation-based learning model. This study highlighted the limitations of traditional methods (e.g., storytelling and role-playing) and demonstrated that simulation-based learning increased teacher creativity and instructional effectiveness. While this model offered a more realistic and engaging learning experience, its primary contribution was situated at the instructional and teacher-competency level. The study did not emphasize children's cognitive skill development, particularly critical thinking, nor did it incorporate rule-based board games that require children to make strategic choices.

A different perspective is offered by Aminah et al. (2024), who examined parental involvement in risk mitigation through local wisdom. Their qualitative findings underscored the importance of integrating cultural values to strengthen children's character and social skills while reducing social risks. Although this study contributes meaningfully to the discourse on holistic risk mitigation and character education, it does not address game-based learning, disaster mitigation content, or cognitive skill development in a classroom context. Thus, its relevance to the present study is conceptual rather than methodological.

Outside the early childhood context, White and Dutta (2025) investigated *Global Warning*, a climate change–themed board game used in higher education. Their findings demonstrated that board game mechanics combining cooperation and competition can promote critical thinking, systems thinking, and reflective learning. This study is particularly relevant to the present research in terms of game design philosophy and its demonstrated impact on critical thinking. However, the participants were post-secondary students, and the game content and cognitive demands were not adapted to early childhood developmental stages.

Thus, this research contributes to early childhood education by integrating critical thinking and disaster mitigation through a modified Monopoly board game. The novelty of MOMI lies in its single-disaster focus, STEAM-based indicators, and problem-solving tasks embedded in gameplay.

Methods

This study followed the ADDIE development model. The analysis stage included direct observation of classroom conditions and identification of the gap in critical thinking development related to disaster scenarios. The design phase involved creating prototype materials tailored to the cognitive level of children aged 5–6 years. The development phase involved expert validation and product revision based on feedback from both media and content experts (Mallevi, 2022).

The implementation stage included trials in a small group of 4 children and a larger group of 21 children in TK ABA 27 Sedayulawas. Effectiveness was measured using a one-group pretest-posttest design. Instruments included observation checklists and performance rubrics based on problem-solving indicators. The Wilcoxon Signed-Rank test and N-Gain score were used to analyze the improvement in critical thinking abilities.

Result and Discussions

The validation results from material and media experts indicated that MOMI is highly feasible (87.5% and 85% respectively). Practicality analysis during the trial showed that teachers and children found the game easy and enjoyable to use (82.8%). Post-test scores were significantly higher than pre-test scores. The Wilcoxon test produced a p-value of 0.000, confirming a statistically significant improvement. The N-Gain score averaged 66.7%, which falls into the high category. The following is a presentation of average value data:

Table 1. *Rank Wilcoxon Test*

Ranks

		N	Mean Rank	Sum of Ranks
Posttest - Pretest	Negative Ranks	0[a]	.00	.00
	Positive Ranks	21[b]	11.00	231.00
	Ties	0[c]		
	Total	21		

a. Posttest < Pretest

b. Posttest > Pretest

c. Posttest = Pretest

Table 2. *Wilcoxon Test Result*

Test Statistics[a]

	Posttest - Pretest
Z	-4.064[b]
Asymp. Sig. (2-tailed)	.000

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

Based on the results of the research data analysis, it can be seen that there is a positive and significant relationship between the pretest results and the posttest results. This is evidenced by the significance value (2-tailed) in the Wilcoxon Matched Pairs test of .000 (<0.001) meaning that this significance value is <0.05 which indicates a positive and significant difference between the pretest results and the posttest results. So it can be concluded that the use of the MOMI game is effective in improving the understanding of earthquake disaster mitigation and improving the critical thinking skills of children aged 5-6 years.

Figure 1. MOMI

This development research was conducted based on a review of the learning process in the field that had never used products to develop an understanding of earthquake disaster mitigation and improve critical thinking skills in PAUD institutions in Lamongan district. The MOMI game contains knowledge about earthquake disaster mitigation such as the causes of occurrence, actions that must be taken when a disaster occurs, impacts, and causes and effects (Aini et al., 2022).

The findings of this study demonstrate that the Monopoly Mitigation Game (MOMI) has a significant and positive impact on improving critical thinking skills and earthquake disaster mitigation understanding among children aged 5–6 years. The statistically significant difference between pretest and posttest scores ($p < 0.05$), supported by a high N-Gain score (66.7%), confirms that structured,

game-based learning can effectively stimulate higher-order cognitive processes in early childhood when appropriately designed.

These results are consistent with previous studies that emphasize the effectiveness of play-based learning in disaster mitigation education for young children. Pranoto et al. (2023) reported that physical fun games significantly improved children's disaster preparedness knowledge and self-rescue skills. Similarly, Cinantya et al. (2021) found that disaster mitigation learning models aligned with early childhood characteristics were valid and effective in enhancing environmental awareness. However, while these studies focused primarily on procedural knowledge and behavioral readiness, the present study extends their findings by demonstrating that disaster mitigation games can also foster critical thinking skills, such as identifying problems, making decisions, and evaluating possible actions.

The effectiveness of MOMI also supports Camilla and Ningrum's (2023) assertion that interactive and game-based media are highly suitable for children in the preoperational stage, as proposed by Piaget. By embedding disaster scenarios within a familiar board game structure, MOMI enables children to actively engage in reasoning processes rather than merely receiving information. This finding addresses a gap in earlier disaster mitigation studies, which often emphasized content delivery or simulation activities without explicitly targeting cognitive skill development (Rahmaniah, 2023).

A key distinction between MOMI and earlier monopoly-based

disaster games, such as MOTANA (Khusna et al., 2023), lies in its single-disaster focus and individual problem-solving orientation. While previous games addressed multiple types of disasters and relied heavily on group collaboration, MOMI concentrates solely on earthquake mitigation, thereby reducing cognitive overload and allowing children to engage more deeply with cause–effect relationships and decision-making tasks. This design choice appears to contribute significantly to the observed improvement in critical thinking, as children are required to analyze situations, anticipate consequences, and choose appropriate responses independently.

Moreover, the integration of structured questions and problem-solving tasks within the gameplay aligns with findings from White and Dutta (2025), who demonstrated that board game mechanics can promote critical thinking and systems thinking. Although their study was conducted in a higher education context, the present research confirms that similar pedagogical principles can be successfully adapted to early childhood settings when the complexity of content and rules is developmentally appropriate.

The high feasibility and practicality scores further indicate that MOMI is not only effective from a cognitive perspective but also realistic for classroom implementation. Unlike mitigation approaches that rely heavily on teacher-led instruction or parental involvement (Aminah et al., 2024), MOMI empowers children to learn actively through guided play, thereby strengthening learner autonomy and engagement. This

represents a meaningful pedagogical shift in early childhood disaster education, moving from knowledge transmission toward cognitive empowerment.

Overall, this study makes a significant contribution to early childhood education by empirically demonstrating that disaster mitigation games can be designed to enhance critical thinking as a core 21st-century competency, not merely disaster awareness or preparedness. The findings position MOMI as an innovative learning medium that bridges disaster education and cognitive skill development, offering a model that can inform future instructional design, curriculum development, and educational policy in disaster-prone contexts.

Conclusion

The Monopoly Mitigation Game (MOMI) is proven to be a valid, practical, and effective learning tool for improving critical thinking skills in early childhood, specifically in the domain of earthquake disaster preparedness. MOMI offers a focused and engaging method for integrating disaster education into early childhood curricula, promoting awareness, and preparing children to respond rationally during emergencies. The game can be implemented in PAUD institutions as part of thematic learning under the Merdeka Curriculum and contributes to strengthening pedagogical strategies that align with 21st-century competencies. Further research may explore the game's adaptation for other types of disasters or broader age groups.

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