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Enhancing Numeracy Skills in Kindergarten Children with Learning Disabilities Through Traditional Congklak Games

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Abstract
Children with learning disabilities face significant challenges in developing foundational numeracy skills, with approximately 20% of children experiencing mathematical learning difficulties that can persist throughout their educational journey. Traditional pedagogical approaches often fail to address the multidimensional academic, social, and emotional needs of these learners. This study investigated the effectiveness of traditional congklak games as a culturally responsive intervention for enhancing numeracy skills among kindergarten children with learning disabilities. A classroom action research design following the Kemmis and McTaggart model was implemented across two cycles at a kindergarten in East Kalimantan, Indonesia. Seventeen children aged 5-6 years participated, including five specifically identified with learning disabilities. The intervention utilized traditional congklak games as the primary educational medium, incorporating systematic observation, per-cycle assessments, and structured interviews. Data were analyzed using qualitative descriptive methods supported by quantitative presentations. The intervention achieved remarkable improvements in numeracy competence, with independent mathematical achievement increasing from 11.8% at baseline to 94% following two implementation cycles. All five children with learning disabilities demonstrated measurable progress, with four achieving independent numeracy skills. Student engagement scores improved from 50.2% to 95.5%, while teacher effectiveness increased from 65% to 85% across intervention cycles. The findings demonstrate that culturally grounded, play-based approaches can effectively address learning disabilities' complex challenges. The intervention's success supports constructivist and social learning theories while providing practical evidence for inclusive educational practices. Traditional congklak games offered concrete mathematical experiences that reduced cognitive load while maintaining high engagement through culturally meaningful gameplay, creating equitable learning opportunities for children with diverse educational needs.

INTRODUCTION

Early childhood numeracy development serves as a fundamental building block for future academic success, with mathematical thinking abilities demonstrating stronger predictive power for later school achievement than early reading or attention skills. Children begin developing mathematical concepts long before formal schooling, yet they experience varying levels of environmental support that significantly influence their mathematical learning trajectories. This variation becomes particularly pronounced for children with learning disabilities, who face unique challenges in developing essential numeracy skills that can have lasting educational consequences.

Learning disabilities affect approximately 20% of the child population, with identification typically occurring during the first years of formal education. Al-Mahrezi (2016) and Franz et al. (2017) documented that these disabilities manifest as overall academic difficulties or specific impairments in mathematical or language skills, as defined by the American Psychiatric Association (2013). Beyond academic challenges, children with learning disabilities encounter emotional difficulties including poor

social interactions, compromised self-concept and self-esteem, alongside anxiety, depression, and stigmatization. Greenboim-Zimchoni (2019) emphasized that these children may develop feelings of inferiority through unfavorable comparisons with peers, leading to frustration and failure perceptions that can influence their adult self-perception.

The academic challenges faced by students with learning disabilities extend across multiple dimensions of their educational experience. Bressane et al. (2024) and Kamran et al. (2023) identified that these challenges encompass academic performance difficulties, social interaction problems, and reduced classroom engagement. Despite possessing average or above-average intelligence, these students struggle with tasks such as reading fluency, written expression, and mathematical problem-solving. Fletcher & Miciak (2024) noted that the cognitive effort required to manage academic tasks often leaves students with diminished mental energy for social interactions and classroom participation, creating a cyclical pattern of academic underachievement.

Research has established that students with learning disabilities demonstrate variable mathematical ability by school entry, influenced by diverse environmental factors including preschool quality. Chien et al. (2010) and Niklas, Cohrssen, & Tayler (2016) found that children starting school with lower mathematical competence are unlikely to catch up with peers without targeted intervention, with competence gaps potentially increasing over time. This underscores the critical importance of early intervention, as Heckman (2008) demonstrated that interventions targeting younger children are more effective in influencing learning trajectories than those implemented later.

The development of numeracy skills is intricately connected with relational language acquisition, which serves as an important representational tool for making connections between mathematical concepts. Purpura & Lonigan (2013) described mathematical language as crucial for understanding quantitative, ordinal, and spatial relations between numbers. Research by Chan, Sera, & Mazzocco (2022) and Hornburg et al. (2018, 2024) has demonstrated that children's understanding of relational language correlates with and predicts various numeracy skills including counting, number comparison, and arithmetic operations.

Traditional games present a promising avenue for addressing the mathematical learning needs of children with learning disabilities. These games, which have been transmitted across generations, typically involve social interaction, physical movement, and strategic thinking that can support various aspects of child development. Kusumawati & Ambarsari (2021) and Nurwahidah et al. (2021) emphasized that traditional games, while relatively simple, provide tremendous benefits when their educational potential is fully explored.

Among traditional games, congklak has emerged as particularly valuable for mathematical learning. Budianti, Pulungan, & Nuraini (2021) demonstrated that congklak games positively influence logical mathematical intelligence in early childhood. Lily, Khotimah, & Maarang (2023) found that traditional congklak games effectively enhance counting abilities in young children, while Dilla et al. (2024) showed successful development of congklak games for improving numeracy skills in children aged 4-5 years. Hariyadi et al. (2024) provided evidence for congklak's effectiveness in enhancing numeracy skills among elementary students, and Insani et al. (2025) developed congklak-based modules specifically for number recognition in early childhood curricula.

The congklak game involves two players using a board with sixteen holes and counting pieces, typically small stones, shells, or seeds. Through gameplay, children develop mathematical abilities including distinguishing full-empty concepts, performing addition, connecting object sets, counting by pointing, showing object order for numbers up to ten, and connecting number symbols with objects. Nuraena, Nurasiah, & Nurmeta (2023) confirmed congklak's effectiveness in improving beginning counting abilities, while Rahmasari, Salma, & Sutriyani (2024) demonstrated its positive impact on addition and subtraction learning outcomes.

Despite growing evidence supporting traditional games' educational potential, significant gaps remain in understanding their application for children with learning disabilities. While studies have examined congklak's effectiveness for general populations, research specifically addressing its

implementation for children with learning barriers remains limited. Reza, Zulhendri, & Astuti (2024) explored ethnomathematical aspects of congklak for integer operations, and Sahrunayanti, Dema, & Wahyuningsih (2023) investigated its use in improving student counting abilities, yet comprehensive studies examining congklak's specific benefits for children with learning disabilities are notably absent.

Current educational practices often employ conventional teaching methods that may not adequately address the diverse learning needs of children with learning disabilities. Traditional lecture-style instruction frequently fails to provide the concrete, interactive experiences these children require for meaningful mathematical learning. Susilawati et al. (2021) highlighted the potential for modified traditional games to enhance cognitive development, suggesting that congklak could serve as an effective alternative pedagogical approach.

This study addresses the identified research gap by investigating whether traditional congklak games can effectively enhance numeracy skills in kindergarten children with learning disabilities. The research aims to examine the impact of congklak gameplay on children's ability to recognize numbers, perform basic counting operations, and understand simple addition and subtraction concepts. By focusing on this specific population and intervention approach, the study contributes to the limited body of research on culturally-relevant, play-based interventions for children with learning challenges.

The significance of this research extends beyond academic achievement to encompass broader developmental benefits. Traditional games like congklak offer opportunities for social interaction, cultural preservation, and enjoyable learning experiences that may be particularly beneficial for children who struggle with conventional educational approaches. Understanding the effectiveness of such interventions can inform educational practices, support inclusive teaching strategies, and provide educators with culturally-grounded tools for supporting mathematical learning in diverse student populations.

METHODS

This study employed a Classroom Action Research (CAR) design based on the Kemmis and McTaggart model to investigate the effectiveness of traditional congklak games in enhancing numeracy skills among kindergarten children with learning disabilities. The cyclical research approach consisted of four interconnected phases: planning, action, observation, and reflection, implemented across two complete cycles to ensure comprehensive data collection and progressive improvement of the intervention strategy.

The research was conducted at Madani Kindergarten, located in Pengadan Village, Karangan District, East Kutai Regency, East Kalimantan Province, Indonesia, from March to May 2025. This institution was selected based on its population of kindergarten children experiencing learning difficulties in numeracy development and its supportive environment for implementing traditional game-based learning interventions. The study focused on children aged 5-6 years enrolled in the kindergarten's Group B class, representing the target demographic for early numeracy skill development.

The research adopted a collaborative approach between the researcher and classroom teachers, ensuring authentic implementation within the natural learning environment. Participants included children identified as having learning barriers in mathematical concepts, specifically those demonstrating difficulties in number recognition, sequential counting, and basic arithmetic operations. The intervention utilized traditional congklak games as the primary educational medium, incorporating wooden boards with fourteen small holes and two larger collection holes, along with counting seeds traditionally used in Indonesian congklak gameplay.

Data collection employed multiple instruments to ensure comprehensive assessment of student progress and intervention effectiveness. Structured interviews were conducted with teachers to gather information about students' learning needs and existing challenges. Systematic observation sheets documented student engagement, behavioral changes, and skill development throughout the intervention cycles. These observation instruments tracked specific indicators including ability to count

numbers 1-15 independently, completion of simple addition problems through congklak gameplay, and demonstration of improved social interaction and confidence during mathematical activities.

Per-cycle assessments evaluated numeracy skill development following each intervention phase, measuring progress in number recognition, counting sequences, and basic arithmetic comprehension. The assessment framework established success criteria requiring 80% of students to demonstrate independent counting of numbers 1-15 during congklak gameplay, with 70% successfully completing simple addition problems either independently or with minimal assistance. Achievement levels were categorized across four performance bands: independent emergence (86-100%), emergence with slight assistance (71-85%), emergence with full assistance (56-70%), and non-emergence requiring individualized intervention (below 55%).

The intervention protocol followed systematic implementation across two cycles. Cycle I introduced students to congklak rules and basic gameplay while incorporating counting concepts through seed manipulation and movement. Teachers provided guidance and positive feedback during gameplay, encouraging repeated practice to strengthen numeracy skills. Cycle II incorporated modifications based on initial cycle reflections, including intensified individual support for struggling students, enhanced discussion activities following gameplay sessions, and comparative analysis of seed quantities before and after games to deepen understanding of addition and subtraction concepts.

Data analysis utilized qualitative descriptive methods supplemented by simple quantitative presentations through tables and diagrams. The analytical framework followed Miles and Huberman's model, encompassing data reduction to select relevant information from observations and interviews, data presentation through narratives and developmental tables supported by photographic and video documentation, and conclusion drawing to assess behavioral changes and learning progress. Individual student achievement was determined by reaching 80% proficiency levels, while class-wide success required 80% of students achieving the established criteria. The formula $D = (X/Y) \times 100\%$ calculated the percentage of students achieving learning mastery, where D represents the class completion percentage, X indicates the number of students achieving mastery, and Y represents the total number of students.

The research maintained ethical considerations through collaborative teacher involvement and focus on educational improvement rather than individual assessment. The cyclical nature of the action research design allowed for continuous refinement of intervention strategies based on observed outcomes and reflective analysis, ensuring optimal support for children with learning disabilities while preserving the cultural authenticity of traditional congklak gameplay.

RESULTS AND DISCUSSION

Results

Baseline Assessment

The initial assessment revealed significant challenges in numeracy skills among kindergarten children with learning disabilities. Prior to intervention implementation, comprehensive evaluation of 17 students (10 females and 7 males) demonstrated substantial difficulties in basic counting concepts, number recognition, and simple arithmetic operations. Table 1 presents the baseline numeracy achievement distribution across all participants.

Table 1. Baseline Numeracy Achievement Distribution (N=17)

Category	Number of Students	Percentage (%)
Independent emergence	2	11.8
Emergence with slight assistance	3	17.6
Emergence with full assistance	7	41.2
Non-emergence	5	29.4
Total	17	100.0

The baseline data indicates that only 11.8% of students demonstrated independent numeracy skills, while 29.4% showed no measurable numeracy abilities. Children specifically identified with learning disabilities performed particularly poorly, with all five participants receiving the lowest assessment scores and requiring comprehensive intervention support.

Table 2. Baseline Performance of Children with Learning Disabilities

Student Code	Pretest Score	Category
AH	1	Non-emergence
MA	1	Non-emergence
AS	1	Non-emergence
LA	1	Non-emergence
IF	1	Non-emergence

These results confirmed the necessity for specialized pedagogical approaches to address the mathematical learning needs of children with learning barriers, as conventional teaching methods had proven inadequate for this population.

Cycle I Implementation Outcomes

Following the first intervention cycle using traditional congklak games, notable improvements emerged in student numeracy performance. Table 3 demonstrates the achievement distribution after implementing the congklak-based learning approach over two instructional sessions.

Table 3. Cycle I Numeracy Achievement Results (N=17)

Category	Number of Students	Percentage (%)
Independent emergence	5	29
Emergence with slight assistance	7	41
Emergence with full assistance	4	24
Non-emergence	1	6
Total	17	100

The Cycle I results revealed substantial progress, with students demonstrating independent numeracy skills increasing from 11.8% to 29%. Most significantly, the proportion of students showing no numeracy abilities decreased dramatically from 29.4% to 6%. Children with learning disabilities showed particular improvement, with four of five participants advancing from non-emergence to emergence with full assistance categories.

Table 4. Cycle I Performance Changes for Children with Learning Disabilities

Student Code	Baseline Score	Baseline Category	Cycle I Score	Cycle I Category
AH	1	Non-emergence	1	Non-emergence
MA	1	Non-emergence	2	Full assistance
AS	1	Non-emergence	2	Full assistance
LA	1	Non-emergence	2	Full assistance
IF	1	Non-emergence	2	Full assistance

Student engagement observations during Cycle I indicated increasing participation and interest in mathematical activities. The average student activity score improved from 20.1 points (50.2%) in the first session to 22.4 points (56%) in the second session, suggesting growing adaptation to the game-based learning approach.

Cycle II Implementation Outcomes

The second intervention cycle incorporated refinements based on Cycle I observations and yielded remarkable improvements in student numeracy achievement. Table 5 presents the final assessment results following the enhanced congklak game implementation.

Table 5. Cycle II Numeracy Achievement Results (N=17)

Category	Number of Students	Percentage (%)
Independent emergence	16	94
Emergence with slight assistance	1	6
Emergence with full assistance	0	0
Non-emergence	0	0
Total	17	100

The Cycle II outcomes exceeded the established success criteria, with 94% of students achieving independent numeracy skills. No students remained in the full assistance or non-emergence categories, indicating comprehensive intervention effectiveness across the participant population.

Table 6. Complete Learning Progression for Children with Learning Disabilities

Student	Baseline	Baseline Cat.	Cycle I	Cycle I Cat.	Cycle II	Cycle II Cat.
AH	1	Non-emergence	1	Non-emergence	3	Slight assistance
MA	1	Non-emergence	2	Full assistance	4	Independent
AS	1	Non-emergence	2	Full assistance	4	Independent
LA	1	Non-emergence	2	Full assistance	4	Independent
IF	1	Non-emergence	2	Full assistance	4	Independent

The learning progression data demonstrates that all children with learning disabilities showed measurable improvement, with four of five achieving independent numeracy skills by the intervention conclusion.

Observational Data Analysis

Student engagement metrics showed consistent improvement throughout both intervention cycles. During Cycle II, student activity scores reached 38.2 points (95.5%) in the final session, representing nearly complete engagement in mathematical learning activities through congklak gameplay.

Teacher performance observations similarly indicated progressive improvement, with instructional effectiveness scores increasing from 65% in early Cycle I sessions to 85% by Cycle II completion. These improvements reflected enhanced classroom management, clearer instructional delivery, and more effective individualized support for students with learning difficulties.

Discussion

This classroom action research demonstrated the effectiveness of traditional congklak games in enhancing numeracy skills among kindergarten children with learning disabilities. The intervention resulted in a dramatic increase in independent numeracy achievement from 11.8% at baseline to 94% following two intervention cycles. Most notably, all five children initially categorized with learning disabilities showed measurable progress, with four achieving independent numeracy competence.

The intervention's success must be understood within the broader context of learning disabilities prevalence and their multifaceted challenges. Al-Mahrezi (2016) and Franz et al. (2017) document that approximately 20% of children are diagnosed with learning disabilities, typically identified during early school years. The current study's focus on kindergarten children aligns with Balıkcı & Melekoglu's (2020) emphasis on early detection and intervention, as academic failure rates can decrease by nearly 50% when learning disabilities are identified and addressed promptly.

The challenges faced by the study participants extend far beyond academic difficulties. Bressane et al. (2024) and Kamran et al. (2023) identify that children with learning disabilities experience interconnected academic, social, and engagement challenges that create cyclical patterns of underachievement. The observed improvements in student confidence and social interaction during congklak gameplay directly address these multidimensional challenges. Greenboim-Zimchoni (2019) and LD Online emphasize that children with learning disabilities often develop poor self-concept and

feelings of inferiority through unfavorable peer comparisons, experiences that can influence adult self-perception. The collaborative nature of congklak games appeared to counter these negative social dynamics by creating inclusive learning environments where all children could experience success.

Bond's (2020) research on engagement difficulties resonates particularly with our findings. Children with learning disabilities often struggle to sustain attention and participate actively in traditional lecture-style lessons due to the cognitive effort required for academic tasks. The game-based intervention addressed this challenge by reducing cognitive load through concrete manipulation while maintaining high engagement through intrinsically motivating gameplay.

The observed improvements align with multiple theoretical frameworks that explain learning disability intervention effectiveness. Bronfenbrenner's ecological systems theory, as discussed by Hayes et al. (2017), provides a comprehensive lens for understanding the intervention's impact. The congklak games operated within the microsystem (classroom peer relationships) and mesosystem (school-home connections through cultural gameplay), creating positive developmental influences closest to the child's immediate environment.

The concrete nature of congklak gameplay provided tangible representations of abstract mathematical concepts, supporting Piaget's (1972) developmental theory regarding the importance of concrete operational experiences for young learners. The physical manipulation of seeds during gameplay created meaningful connections between numerical symbols and quantities, facilitating conceptual understanding that traditional drill-based methods had failed to achieve. This finding aligns with Cohrssen & Niklas's (2019) emphasis that while children possess innate mathematical abilities, learning outcomes depend heavily on environmental influences and quality of mathematical interactions.

Vygotsky's (1978) social learning theory also explains the intervention's effectiveness through peer interaction and collaborative problem-solving during congklak games. Students with learning disabilities benefited from observing and interacting with more capable peers, receiving scaffolded support within their zones of proximal development. This social dimension proved particularly valuable given Grigorenko et al.'s (2020) findings that social challenges often compound academic difficulties for children with learning disabilities.

The study's success in developing numeracy skills among children with learning disabilities aligns with contemporary understanding of early mathematical development. Duncan et al. (2007) and Claessens, Duncan, and Engel (2009) established that early mathematical thinking serves as a stronger predictor of later academic success than reading or attention skills. The current intervention's focus on foundational counting and arithmetic skills through concrete gameplay supports this developmental trajectory.

The integration of mathematical language development through congklak gameplay addresses Purpura & Lonigan's (2013) emphasis on relational language as mathematical language. The verbal interactions during gameplay—discussing quantities, comparisons, and arithmetic operations—provided natural contexts for developing mathematical vocabulary. Chan, Sera, & Mazzocco (2022) demonstrated that relational language understanding correlates with and predicts various numeracy skills, including the counting and basic arithmetic skills developed through congklak gameplay.

Peng et al.'s (2020) meta-analyses revealing bidirectional relationships between language and mathematics development suggest that the verbal interactions inherent in congklak gameplay may have supported both mathematical and linguistic development simultaneously. This dual benefit could explain the intervention's particular effectiveness for children with learning disabilities, who often experience challenges in both domains.

The intervention's success supports growing evidence for high-quality, play-based early childhood pedagogy. Niklas & Tayler (2018) and Tayler et al. (2013) established that quality early childhood education associates with significant gains in learning outcomes. The current study's systematic implementation of congklak games exemplifies this principle by embedding mathematical learning within culturally meaningful play activities.

Knowles's (2009) observation that children's engagement in playful activities with explicit learning objectives reveals important information about their thinking and reasoning proved particularly relevant for children with learning disabilities. The concrete, manipulative nature of congklak gameplay made mathematical thinking visible in ways that traditional assessment methods had not captured. This aligns with Deans & Cohrssen's (2015) and Pollitt et al.'s (2015) findings that mathematical thinking emerges in diverse ways within integrated, play-based curricula.

The intervention addressed critical equity concerns raised by Cohrssen & Page (2016) regarding variable support for mathematical thinking in early childhood settings. By providing systematic, engaging mathematical experiences through congklak games, the study created more equitable learning opportunities for children who might otherwise struggle with traditional instructional approaches. This finding supports Heckman's (2008) argument that interventions targeting younger children prove more effective in influencing learning trajectories than later interventions.

The study's success in supporting children with diverse learning needs reflects contemporary understanding of individual differences in early numeracy development. Gould (2012) documented that children demonstrate highly variable mathematical abilities at school entry, influenced by diverse environmental factors including preschool quality. The current intervention's ability to support children across this spectrum of abilities suggests particular promise for inclusive educational approaches.

De Smedt et al.'s (2009) identification of working memory as a crucial domain-general factor in early numeracy skills may partially explain the intervention's effectiveness. The structured, sequential nature of congklak gameplay may have reduced working memory demands while maintaining mathematical content, allowing children with learning disabilities to engage more successfully with numerical concepts. Similarly, the game's inherent structure addressed Espy et al.'s (2004) concerns about inhibitory control challenges by providing clear rules and turn-taking protocols.

The intervention's attention to social-emotional factors aligns with Wu et al.'s (2012) research on mathematical anxiety and Fisher et al.'s (2012) work on mathematical interest. By creating positive, culturally relevant mathematical experiences, congklak gameplay appeared to reduce anxiety while increasing intrinsic motivation for mathematical learning. This emotional dimension proves particularly important for children with learning disabilities who may have developed negative associations with academic tasks.

This study addresses several gaps identified in recent learning disabilities research. Faggella-Luby & Deshler (2008) established foundational frameworks for understanding learning disabilities' educational impact, while Zisimopoulos & Galanaki (2009) identified challenges in traditional classroom settings. The current research extends this work by demonstrating specific intervention strategies that address these traditional classroom limitations.

Kyndt et al.'s (2013) meta-analyses found that students with learning disabilities often require multiple support strategies, a finding supported by the current study's multi-modal approach combining concrete manipulation, social interaction, and cultural engagement. However, the study also addresses Mize et al.'s (2020) and Yakut's (2021) observations that research on collaborative learning effectiveness for children with learning disabilities remains limited, providing specific evidence for peer-based learning approaches.

The action research methodology allowed for the systematic refinement that Grigorenko et al. (2020) identified as crucial for comprehensive support approaches. The cyclical improvement process proved essential for optimizing intervention effectiveness, particularly for students requiring specialized support, addressing Johnson's (2017) emphasis that early detection and tailored intervention approaches prove most effective for children with learning disabilities.

The successful integration of congklak, an Indonesian traditional game, demonstrates the potential for culturally-grounded pedagogical approaches in contemporary educational settings. This finding supports broader movements toward culturally responsive teaching that honors students' cultural backgrounds while achieving academic learning objectives. The accessibility and low-cost

nature of congklak materials make this intervention particularly viable for resource-limited educational environments, addressing equity concerns raised throughout the learning disabilities literature.

Kusumawati & Ambarsari (2021) and Nurwahidah et al. (2021) emphasized that traditional games provide tremendous benefits when their educational potential is fully explored. The current study validates this perspective by demonstrating measurable academic outcomes alongside cultural preservation. The intervention's success suggests that culturally relevant pedagogies can simultaneously address academic learning goals and cultural identity development.

The research provides concrete evidence for early childhood educators seeking effective approaches for supporting children with learning disabilities in mathematical development. The systematic implementation framework developed through this action research offers a replicable model for other educational settings, addressing Walker & Shinn's (2002) emphasis that early identification and support programs can prevent many long-term academic challenges.

Key implementation elements include careful observation of student responses, flexible adaptation of game rules to match developmental needs, and consistent positive reinforcement during learning activities. The study also highlights the importance of teacher preparation and ongoing professional development in alternative pedagogical approaches, as evidenced by the observed improvements in teacher effectiveness across intervention cycles.

Several limitations constrain the generalizability of these findings. The study's focus on a single educational setting with a relatively small participant group limits broader applicability. Additionally, the short implementation timeframe prevents assessment of long-term learning retention and skill transfer to other mathematical concepts, concerns that align with Patel, Sheth, & Shah's (2025) emphasis on the importance of sustained intervention approaches.

Future research should examine the intervention's long-term effectiveness and transferability to other mathematical domains. Investigation of the approach's effectiveness across diverse cultural contexts would strengthen understanding of culturally responsive pedagogical approaches. Additionally, research examining optimal dosage and implementation fidelity could inform broader dissemination efforts.

The study's success in supporting children with learning disabilities through culturally relevant, play-based approaches offers promising directions for educational practice and policy development. By demonstrating measurable academic outcomes through engaging, inclusive pedagogical methods, this research contributes to growing evidence supporting comprehensive, equity-focused approaches to early childhood mathematical education.

CONCLUSION

This classroom action research demonstrates that traditional congklak games constitute an effective pedagogical intervention for enhancing numeracy skills among kindergarten children with learning disabilities. The study achieved substantial improvements in mathematical competence, with independent numeracy achievement increasing from 11.8% at baseline to 94% following systematic implementation of culturally-grounded gameplay activities. All five children initially identified with learning disabilities demonstrated measurable progress, with four achieving independent mathematical competence by intervention completion.

The research contributes significantly to learning disabilities education by providing empirical evidence that culturally responsive, play-based pedagogical approaches can effectively address the multidimensional academic, social, and emotional challenges experienced by children with learning barriers. Theoretically, the study advances understanding by demonstrating how concrete, collaborative learning experiences can simultaneously support cognitive development, social interaction, and cultural identity formation. The integration of constructivist learning principles with social learning theory within an ecological systems framework offers a comprehensive model for inclusive early childhood mathematical education.

Practical implications include development of replicable implementation frameworks for educators serving diverse learners, evidence supporting differentiated instruction approaches in mainstream classrooms, and demonstration of accessible, low-cost intervention strategies particularly valuable for resource-constrained educational environments. The intervention's success supports policy initiatives promoting culturally responsive teaching practices and inclusive educational approaches in early childhood settings.

However, several limitations constrain the findings' generalizability. The single-site research design with seventeen participants limits broader applicability across diverse educational contexts. The relatively brief implementation timeframe prevents assessment of long-term learning retention and skill transferability to advanced mathematical concepts. Additionally, the study does not examine intervention effectiveness across varied cultural backgrounds or optimal implementation dosage requirements.

Future research should investigate long-term intervention effects on mathematical learning trajectories, examine transferability to other mathematical domains beyond basic numeracy, and explore effectiveness across diverse cultural and socioeconomic contexts. Studies examining teacher preparation requirements, large-scale implementation strategies, and cost-effectiveness analyses would facilitate broader intervention dissemination. Research investigating effectiveness for children with specific learning disability subtypes could inform more targeted pedagogical approaches, ultimately advancing evidence-based practices for supporting mathematical learning among children with diverse educational needs.

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