JOURNAL OF INNOVATION AND RESEARCH IN PRIMARY EDUCATION | ISSN 2829-775X
Vol. 4, No. 4, 2025, 2652-2666
https://doi.org/10.56916/jirpe.v4i4.2147

Play-Based Contextual Learning for Pre-Reading Development in Preschoolers with ADHD Risk Factors

Juni Nuri Astuti*
Universitas Negeri Yogyakarta, Indonesia

Aini Mahabbati
Universitas Negeri Yogyakarta, Indonesia

***Corresponding Author:** juninuri.2024@student.uny.ac.id

Keywords
ADHD
pre-reading skills
contextual learning
play-based education
executive function

Article History
Received yyyy-mm-dd
Accepted yyyy-mm-dd

Abstract
Children at risk for ADHD frequently experience difficulties in developing pre-reading skills due to challenges with attention regulation and executive function. This study investigated the effectiveness of play-based contextual learning methods in enhancing pre-reading abilities among preschool children exhibiting ADHD risk characteristics. A classroom action research design following the Kemmis and McTaggart model was implemented over two cycles with two children (aged 5-6 years) identified as at risk for ADHD at State Kindergarten 2 Kaubun. The intervention integrated Contextual Teaching and Learning (CTL) principles through play-based activities using familiar materials (vegetables) to teach letter recognition, phonemic awareness, and word formation. Data collection employed pre-reading ability assessments, structured observations, and documentation of behavioral changes across baseline, Cycle 1, and Cycle 2 phases. Substantial improvements were observed from baseline to final assessment: Subject AY progressed from 27.77% to 83.33%, while Subject AL advanced from 30.55% to 88.88% proficiency. Both participants exceeded the 75% threshold for independent skill demonstration. Qualitative observations revealed enhanced attention regulation, increased engagement, and improved self-regulation behaviors throughout the intervention period. The findings demonstrate that culturally responsive, multisensory play-based approaches effectively address both cognitive and behavioral domains in children at risk for ADHD. The intervention's success supports the integration of constructivist learning principles with inclusive educational practices, providing evidence for combined treatment approaches addressing reading difficulties and attention challenges simultaneously.

INTRODUCTION

Early childhood education represents a critical foundation for lifelong learning success, with the period from birth to six years constituting a golden age of rapid neurological development where appropriate educational interventions can yield lasting benefits. Neural speech processing ability during infancy appears to be a very early indicator of future linguistic skills, as language development begins when infants learn to extract relevant acoustic features from native language speech (Kuhl, 2004; Kujala et al., 2023). Within this developmental window, pre-reading skills emerge as fundamental competencies that significantly influence subsequent academic achievement. Before reading itself can emerge, preschool children must develop literacy-related abilities known as pre-reading skills, with children experiencing difficulties in basic pre-reading skill acquisition at early ages being more likely to experience learning disabilities at school age (Pennington & Lefly, 2001; Puolakanaho et al., 2007; Torppa et al., 2010; Whitehurst & Lonigan, 1998). These foundational literacy abilities encompass letter recognition, phonemic awareness, understanding symbol-sound relationships, and listening comprehension skills that collectively prepare children for formal reading instruction.

The significance of pre-reading skill development becomes particularly pronounced when considering children at risk for Attention Deficit Hyperactivity Disorder (ADHD), a neurodevelopmental condition affecting approximately 5-10% of school-aged children. Developmental dyslexia and ADHD frequently co-occur, with up to 40-50% of children with one diagnosis meeting criteria for the other (Boada et al., 2012; DuPaul et al., 2013; Shaywitz et al., 1990; Visser et al., 2014; Willcutt et al., 2010). Children exhibiting ADHD risk factors typically demonstrate persistent patterns of inattention, hyperactivity, and impulsivity that interfere with their ability to engage effectively in traditional learning environments. Among various pre-reading skills, the strongest predictors of subsequent reading are phonological awareness and letter knowledge, though this may vary depending on children's language or orthography (Christopher et al., 2015; Gallagher et al., 2000; Helland & Morken, 2016; Kirby et al., 2003; Lyytinen et al., 2006).

Executive function deficits commonly accompany both developmental dyslexia and ADHD, with individuals demonstrating impairments in cognitive abilities necessary for goal-setting, behavioral control, and managing complex higher-order cognitive processes (Daucourt et al., 2018; Doyle, 2006; Jurado & Rosselli, 2007; Lonergan et al., 2019). Performance on executive function measures as early as kindergarten serves as concurrent and longitudinal predictors of reading achievement, with children demonstrating impaired reading abilities also showing weaker executive function skills in verbal and visual working memory, response inhibition, and attention switching (Altemeier et al., 2008; Carretti et al., 2009; Cutting et al., 2009; McClelland et al., 2014; Pascual et al., 2019). Two specific executive functions well-studied in relation to reading are inhibition and switching, both of which are often impaired in developmental dyslexia and ADHD, with processing speed also being reduced in both conditions (Laasonen et al., 2009; McGrath et al., 2011; Mostofsky et al., 2003; Shanahan et al., 2006; Willcutt et al., 2005, 2010).

Current pedagogical approaches in early childhood education often fail to adequately address the learning needs of children at risk for ADHD, typically employing conventional methods such as repetitive drilling and verbal instruction that prove ineffective for learners with attention and impulse control challenges. Traditional instructional strategies frequently lack the engaging, concrete, and experientially relevant characteristics necessary to capture and maintain the attention of children with ADHD risk factors. This pedagogical gap necessitates the exploration of alternative teaching methodologies that can accommodate diverse learning needs while promoting optimal pre-reading skill development.

Contextual learning approaches provide frameworks by connecting academic content with real-life experiences, operating on the principle that learning occurs when students process information within their experiential reference frames (Davtyan, 2014; Hull, 1995). According to constructivist philosophy, contextual approaches emphasize that learning extends beyond memorization to meaningful knowledge construction, with students building knowledge through experience and scaffolded assistance (Suryawati & Osman, 2017; Vygotsky, 1978). International research has demonstrated contextual learning effectiveness in various cultural contexts (Ome & Menendez, 2022; Ray et al., 2021; Sampa et al., 2018).

Play-based learning methodologies offer promising avenues for addressing the educational needs of children at risk for ADHD while promoting pre-reading skill development. Play-based learning through traditional games promotes various skills including socialization, cooperation, self-esteem, problem-solving, and critical thinking abilities (Ejuu, 2019; Ng'asike & Swadener, 2019). Research across diverse cultural contexts demonstrates that children acquire cognitive and social skills when culturally familiar games are incorporated into teaching, with effectiveness enhanced when teaching occurs in natural environments using locally relevant methods (Madondo & Tsikira, 2021; Moloi et al., 2021; Muir et al., 2024; Nakawa, 2020; Tembo et al., 2018). The Family-School-Community partnership framework emphasizes stakeholder connections, with research showing that interactions between families, schools, and communities can jointly support play-based learning experiences (Epstein & Sanders, 2002; Keung & Cheung, 2019a). Nature-based early learning environments

extend play-based pedagogy benefits, supporting children's physical, social, emotional, and cognitive development through diverse outdoor experiences (Dankiw et al., 2020; Mygind et al., 2019; Tillmann et al., 2018).

Despite growing recognition of play-based and contextual learning benefits, significant gaps remain in understanding how these approaches can be effectively integrated to support pre-reading development in children at risk for ADHD. Current neuroimaging research has not adequately disentangled the influences of ADHD characteristics and executive function deficits on reading-related brain activations, limiting theoretical understanding of optimal intervention strategies. Furthermore, limited research exists examining the specific mechanisms through which contextual play-based interventions influence pre-reading outcomes in this vulnerable population.

This study addresses these knowledge gaps by investigating the effectiveness of play-based contextual learning methods in enhancing pre-reading abilities among children at risk for ADHD. The research aims to determine how integrating meaningful, experience-based play activities within natural learning contexts can improve letter recognition, phonemic awareness, and related pre-reading competencies. Additionally, the study seeks to understand the processes through which such interventions influence learning outcomes and engagement patterns in children exhibiting ADHD risk characteristics.

The significance of this research extends beyond immediate educational outcomes to encompass broader implications for inclusive early childhood pedagogy and evidence-based practice development. Findings may inform teacher preparation programs, curriculum design initiatives, and policy decisions affecting early childhood education services for diverse learners. By demonstrating the potential of contextual play-based approaches to address the unique learning needs of children at risk for ADHD, this study contributes to the growing body of knowledge supporting responsive, inclusive educational practices that promote optimal developmental outcomes for all children during the critical early learning period.

METHODS

This study employed a classroom action research design following the Kemmis and McTaggart spiral model to improve pre-reading abilities in children at risk for ADHD through play-based contextual learning methods. The action research approach was selected to enable systematic observation and iterative improvement of pedagogical practices while addressing real classroom challenges. The research was conducted over one month with two cycles, each comprising four phases: planning, action implementation, observation, and reflection.

The study was conducted at State Kindergarten 2 Kaubun, which provided appropriate facilities including spacious classrooms, play areas, and educational toys supporting the implementation of play-based contextual learning methods. Participants were selected using purposive sampling from Group B children aged 5-6 years. Two children exhibiting ADHD risk characteristics were identified as primary subjects based on initial observations conducted by researchers and classroom teachers, along with confirmation from previous developmental records. These children consistently demonstrated symptoms of inattention (difficulty maintaining focus), hyperactivity (frequent purposeless movement), and impulsivity (acting without thinking) across various learning activities, including pre-reading tasks. While lacking formal medical diagnosis, their behavioral characteristics aligned with commonly used ADHD risk indicators in early childhood educational assessment.

Data collection employed multiple instruments to ensure comprehensive assessment. Pre-reading ability tests measured children's letter recognition, phonemic awareness, and simple word formation skills before and after intervention. The assessment utilized a four-point scale evaluating three key aspects: identifying initial letters of words, imitating letter sounds, and arranging letters into simple words from vegetable names. Classroom observation instruments documented learning processes using structured observation sheets covering preliminary, core, and closing activities based on Contextual Teaching and Learning (CTL) principles including constructivism, inquiry, questioning,

learning community, modeling, reflection, and authentic assessment. Documentation methods included daily journals, anecdotal records, and photographic evidence of children's work and behavioral changes during learning activities.

The intervention implemented play-based activities integrating CTL approaches, including letter recognition games using vegetable cards, creating letters from natural materials (stones, beans, corn kernels), and collaborative letter arrangement activities. Cycle I focused on basic letter and sound recognition through concrete manipulative activities, while Cycle II incorporated enhanced community learning elements and outdoor letter-finding games based on Cycle I reflection results. Each learning session lasted approximately 60 minutes, conducted twice weekly with flexible, interactive facilitation addressing individual needs of children with ADHD characteristics who required enhanced attention to visual stimulation, motor movement, and clear verbal instructions.

Data analysis employed descriptive statistics to calculate achievement scores using the formula: Score = (Obtained Score/Maximum Score) × 100%. Success criteria were established using a four-level scale: 1 (no emergence), 2 (emergence with full teacher assistance), 3 (emergence with minimal assistance), and 4 (independent and consistent emergence). Qualitative data from observations and documentation were analyzed thematically to identify patterns in behavioral changes, engagement levels, and learning processes. The research was considered successful if children demonstrated significant improvement in pre-reading abilities, enhanced focus and self-regulation during activities, and positive responses toward learning as evidenced by increased participation and enthusiasm in educational sessions.

RESULTS AND DISCUSSION

Results

Pre-Action Baseline Assessment

The research commenced with a baseline assessment conducted on May 5, 2025, to establish the initial pre-reading abilities of participants before implementing the play-based contextual learning intervention. This pre-action phase involved two children (AY and AL) identified as at risk for ADHD based on prior observations and developmental records. During this baseline assessment, conventional teaching methods were employed without contextual learning strategies or concrete manipulative materials.

Table 1 presents the baseline pre-reading assessment scores for both participants before intervention implementation.

Table 1. Pre-Action Baseline Assessment Results

Subject	Maximum Score	Pre-Action Score	Percentage
AY	36	10	27.77%
AL	36	11	30.55%

The baseline data in Table 1 reveals that both subjects demonstrated significantly low pre-reading abilities prior to intervention. Subject AY achieved 27.77% of the maximum possible score, while AL scored slightly higher at 30.55%. Both scores fell below the 40% threshold typically associated with emerging developmental skills in early childhood education standards. The minimal difference of 2.78% between subjects indicated comparable baseline abilities, suggesting both children required substantial intervention to develop foundational literacy skills.

Cycle 1 Implementation and Outcomes

Following the baseline assessment, Cycle 1 was implemented over two sessions (May 19 and May 21, 2025) using play-based contextual learning methods focused on vegetable themes. The intervention incorporated seven CTL principles: constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment.

Table 2 displays the progressive improvement in pre-reading abilities throughout Cycle 1 compared to baseline performance.

Table 2. Pre-Reading Assessment Results: Baseline to Cycle 1

Subject	Maximum Score	Baseline Score	Cycle 1 Session 1	Cycle 1 Session 2	Baseline %	Session 1 %	Session 2 %
AY	36	10	13	19	27.77%	36.11%	52.77%
AL	36	11	17	21	30.55%	47.22%	58.33%

Table 2 demonstrates notable improvement for both participants during Cycle 1. Subject AY progressed from 27.77% at baseline to 52.77% by the second session, representing a 25% increase. Subject AL advanced from 30.55% to 58.33%, showing a 27.78% improvement. These gains indicated that the play-based contextual learning approach successfully engaged children at risk for ADHD in pre-reading activities, though both subjects still required substantial teacher assistance to complete tasks successfully.

Cycle 2 Implementation and Final Outcomes

Cycle 2 was conducted on May 26 and May 28, 2025, incorporating refinements based on Cycle 1 reflections. The intervention expanded vegetable variety to include pumpkin, tomato, and carrot while maintaining the same CTL framework with enhanced individual support and activity variation. Table 3 presents the comprehensive results comparing performance across both intervention cycles.

Table 3. Comprehensive Pre-Reading Assessment Results: Cycles 1 and 2

Subject	Maximum Score	Cycle 1 Session 1	Cycle 1 Session 2	Cycle 2 Session 1	Cycle 2 Session 2	Cycle 1 S1 %	Cycle 1 S2 %	Cycle 2 S1 %	Cycle 2 S2 %
AY	36	13	19	25	30	36.11%	52.77%	69.44%	83.33%
AL	36	17	21	26	32	47.22%	58.33%	72.22%	88.88%

The final assessment results in Table 3 reveal substantial progress for both participants. Subject AY achieved 83.33% proficiency by Cycle 2 completion, representing a 55.56% total improvement from baseline. Subject AL reached 88.88% proficiency, demonstrating a 58.33% overall gain. Both participants exceeded the 75% threshold established for independent skill demonstration, indicating successful intervention outcomes.

Observed Behavioral and Engagement Changes

Beyond quantitative improvements, qualitative observations revealed significant behavioral modifications throughout the intervention period. Initially, both subjects exhibited typical ADHD risk characteristics including difficulty maintaining focus, frequent position changes, and requiring repeated instructions. During Cycle 1, participants began demonstrating increased engagement with concrete materials, though they continued requiring substantial teacher support for task completion.

By Cycle 2, both children displayed enhanced self-regulation, increased confidence in attempting letter recognition tasks, and improved ability to work collaboratively with peers. They demonstrated greater persistence in completing letter arrangement activities and showed enthusiasm for sharing their work with classmates. These behavioral improvements complemented the quantitative gains in pre-reading abilities.

Discussion

The results demonstrate that play-based contextual learning methods significantly enhanced pre-reading abilities in children at risk for ADHD. The substantial improvements observed from baseline (27.77% and 30.55%) to final assessment (83.33% and 88.88%) support the effectiveness of CTL approaches for this population. These findings are particularly significant given that developmental dyslexia and ADHD are among the most prevalent neurodevelopmental disorders, with each affecting approximately 5-10% of school-aged children, and frequently co-occurring with up to 40-50% of

children with one diagnosis meeting criteria for the other (Boada et al., 2012; DuPaul et al., 2013; Shaywitz et al., 1990; Visser et al., 2014; Willcutt et al., 2010).

The success of this intervention can be attributed to several key factors that address the complex relationship between ADHD and reading development. Children with difficulties in acquiring basic pre-reading skills at early ages are more likely to experience learning disabilities at school age (Pennington & Lefly, 2001; Puolakanaho et al., 2007; Torppa et al., 2010). The intervention's focus on foundational skills aligns with research showing that among various pre-reading skills, the strongest predictors of subsequent reading are phonological awareness and letter knowledge (Christopher et al., 2015; Gallagher et al., 2000; Helland & Morken, 2016; Kirby et al., 2003; Lyytinen et al., 2006).

The use of concrete materials and real-world contexts (vegetables) provided tangible connections between abstract letter concepts and children's daily experiences. Davtyan (2014) noted that contextual learning operates on the principle that learning occurs when students process information within their experiential reference frames, which was clearly demonstrated in this study. This approach is further supported by research indicating that quality early childhood education promoting social-emotional and cognitive skills is most effective when teaching occurs in natural environments using approaches that are local and familiar to learners (Bleses et al., 2021; Madondo & Tsikira, 2021; Muir et al., 2024).

The observed improvements align with constructivist learning theory, which emphasizes active knowledge construction through hands-on experiences. Vygotsky (1978) argued that learning occurs most effectively when children receive scaffolded assistance within their zone of proximal development. The graduated support provided by teachers in this study, moving from full assistance to minimal guidance, exemplifies this principle in practice.

The social learning component of CTL also contributed to intervention success. The learning community approach enabled peer interaction and collaborative learning, consistent with research by Epstein and Sanders (2002) on family-school-community partnerships. Children at risk for ADHD benefited from observing and modeling appropriate learning behaviors demonstrated by peers and teachers.

The behavioral changes observed throughout the intervention suggest improvements in executive function domains commonly impaired in ADHD. Executive function is highly related to learning to read, with performances on EF measures as early as kindergarten serving as concurrent and longitudinal predictors of reading achievement (Altemeier et al., 2008; Birgisdottir et al., 2015; Doyle et al., 2018; McClelland et al., 2014; Pascual et al., 2019; van der Sluis et al., 2007). The enhanced focus, persistence, and self-regulation displayed by participants indicate that the play-based contextual learning approach addressed not only pre-reading skills but also underlying cognitive processes essential for academic success.

Individuals with developmental dyslexia and ADHD commonly demonstrate deficits in executive function, which encompasses cognitive abilities necessary for setting and monitoring goals, controlling behavior, and managing complex higher-order cognitive processes (Daucourt et al., 2018; Doyle, 2006; Jurado & Rosselli, 2007; Lonergan et al., 2019; Poljac et al., 2010; Willcutt et al., 2005). The intervention's success in improving behavioral regulation is particularly noteworthy because correlational studies have found that children with impaired reading abilities also have weaker EF skills in verbal and visual working memory, response inhibition, and switching attention (Carretti et al., 2009; Cutting et al., 2009; Kibby et al., 2021; Locascio et al., 2010; Lonergan et al., 2019; Reiter et al., 2005).

Two specific executive functions well-studied in relation to reading are inhibition and switching, with substantial evidence showing impairments in both developmental dyslexia and ADHD (Daucourt et al., 2018; Lonergan et al., 2019; Mostofsky et al., 2003; Poljac et al., 2010; Willcutt et al., 2005; Wodka et al., 2007). During reading, inhibition may be required to ignore task-irrelevant information and focus on relevant visual information, while switching may be required to utilize different reading processes (Butterfuss & Kendeou, 2018; Doyle et al., 2018). The structured yet flexible nature of the

play-based activities provided opportunities for children to practice these self-regulation skills within an engaging context.

Processing speed, which is reduced in both developmental dyslexia and ADHD and may provide the best discrimination between dyslexia and typical reading, was also implicitly addressed through the intervention's pacing and multisensory approach (Booth et al., 2010; Catts et al., 2002; Laasonen et al., 2009; McGrath et al., 2011; Shanahan et al., 2006; Willcutt et al., 2010).

These findings are consistent with previous studies demonstrating the effectiveness of play-based learning for children with attention difficulties. Traditional games and play-based activities have been shown to promote socialization, cooperation, self-esteem, problem-solving, and critical thinking abilities, with studies in African contexts showing children acquiring cognitive and social skills when local games are incorporated into teaching (Ejuu, 2019; Moloi et al., 2021; Nakawa, 2020; Ng'asike & Swadener, 2019; Tembo et al., 2018).

Research has demonstrated that traditional games equipped learners with athletic, rhythmic, and manipulative knowledge, along with social, hygienic, and critical thinking skills, with children learning various social skills of respect, emotional control, accepting defeat, and self-control through teacher-guided activities (Tembo et al., 2018). Similarly, Matafwali and Mofu (2023) noted that play-based learning through indigenous games serves as resource capital for enhancing acquisition of social-emotional, cognitive, physical, and literacy skills in early childhood settings.

The cultural relevance of using familiar objects (vegetables) in this study parallels research emphasizing that teaching approaches are most effective when they are local and familiar to learners, varying from place to place due to cultural and social backgrounds of specific communities (Bleses et al., 2021; Bleses et al., 2024; Madondo & Tsikira, 2021; Muir et al., 2024; Munsaka & Kalinde, 2017). This cultural responsiveness likely contributed to the high engagement levels observed among participants, supporting Ejuu's (2019) assertion that traditional games are important for enhancing acquisition of cultural values and norms in society.

Research has shown that teachers can effectively implement play-based learning when developmentally appropriate games are accessible and well-understood regarding application and expected learning outcomes (Tachie & Galawe, 2021). However, lack of knowledge and skills in teachers regarding appropriate use of traditional games to teach specific aspects remains a challenge (Nakawa, 2020), suggesting the need for professional development in implementing such approaches effectively.

The success of this intervention gains additional significance when considered within the broader context of neurobiological research on reading development. Language and reading abilities are crucial for children's cognitive development, with neural speech processing ability during infancy serving as an early indicator of future linguistic skills, as language development begins when infants learn to extract relevant acoustic features from native language speech (Kuhl, 2004; Kujala et al., 2023). This underscores the importance of early identification and intervention, as earlier identification of deficient neural processes underlying developmental disabilities is essential for detecting those at highest risk and designing preventive intervention strategies.

Research using auditory event-related potentials has demonstrated associations between early neural processing and reading skills at school age (Choudhury & Benasich, 2011; Hämäläinen et al., 2018; Leppänen et al., 2010; Lohvansuu et al., 2018). However, there remains a notable gap in research for the preschool stage, which this study begins to address through its focus on pre-reading intervention during this critical developmental period.

The intervention's emphasis on phonological awareness and letter knowledge is particularly well-founded, as these represent the strongest predictors of subsequent reading, though this may vary depending on children's language or orthography and genetic and environmental influences (Aro, 2004; Christopher et al., 2015; Landerl et al., 2013). The study's inclusion of auditory working memory components through multisensory activities aligns with research showing this as a significant pre-reading skill, with phonological awareness, auditory working memory, and serial naming

encompassed under "phonological processing" (Christopher et al., 2015; Helland & Morken, 2016; Kirby et al., 2003; Landerl et al., 2013; Moll et al., 2014).

The findings support the multiple cognitive deficit hypothesis of developmental dyslexia and ADHD presentation, where children with either or both conditions show significant deficits on executive function measures compared to typically developing children, with similar patterns between dyslexia-only and combined presentations (Kibby et al., 2021; Lonergan et al., 2019; McGrath et al., 2011; Pennington, 2006; Pennington et al., 2012; Willcutt et al., 2010). Importantly, intervention efforts have found that children with both reading disability and ADHD benefit from combined treatment approaches (Tamm et al., 2017), which aligns with this study's integrated approach addressing both cognitive and behavioral domains.

The intervention's success is particularly noteworthy given that only about half of children and adults with ADHD demonstrate impaired executive function performance, and ADHD and executive function can be dissociated both behaviorally and neurally (Biederman et al., 2004, 2006; Doyle et al., 2005; Fair et al., 2012; Lambek et al., 2010; Mattfeld et al., 2015; Nigg et al., 2005; Sonuga-Barke, 2005). This suggests that the play-based contextual approach may be effective across different ADHD presentations, regardless of executive function status.

The intervention's success can also be understood through the lens of broader educational ecosystems. Research reveals a growing consensus about the crucial roles played by parents and society in facilitating play-based learning, with parental involvement enhancing children's experience of play and building developmental capacity (Addi-Raccah & Grinshtain, 2016; Keung & Cheung, 2019a; Rogers, 2010; Siu & Keung, 2022a; Winter & Hollingsworth, 2015; Wood, 2009). The study's implementation within a kindergarten setting, while not explicitly involving families, demonstrates the potential for scaling such approaches within Family-School-Community partnership frameworks that emphasize connections between stakeholders (Epstein & Sanders, 2002; Farrell et al., 2004; Keung & Cheung, 2019a).

Research has shown that characteristics of child, family, and school are associated with children's play and learning, though few studies have analyzed how different social groups contribute through relationships and interactions (Hayes et al., 2017; Hindman et al., 2010). The integration of culturally familiar materials (vegetables) in this study reflects the importance of school-based and family-based programs being integrated with culture and games that teachers use to teach specific skills (Bleses et al., 2024; Matafwali & Mofu, 2023).

While this study was conducted indoors, its principles align with emerging research on nature-based early learning approaches. Research suggests that nature-based early learning centers benefit children's physical, social, emotional, and cognitive development, with diverse natural environments enabling various play types and peer interaction opportunities (Dankiw et al., 2020; Johnstone et al., 2022; Mygind et al., 2019; Tillmann et al., 2018; Truelove et al., 2018). The combination of socializing, playing, and engaging in physical activity in natural settings improves outcomes such as motor development, social development, self-regulation, and attention (Mygind et al., 2019; Tillmann et al., 2018) - outcomes that parallel those observed in this study's structured indoor environment.

Access to quality green spaces has been shown particularly important for promoting play and healthy child development in children from disadvantaged backgrounds (Mitra et al., 2020; Riazi et al., 2021; Spencer et al., 2020). This suggests potential for extending contextual learning approaches to outdoor settings, particularly for children with ADHD who may benefit from additional sensory and movement opportunities that natural environments provide.

These findings provide evidence that play-based contextual learning represents a viable alternative to traditional drill-based literacy instruction for children at risk for ADHD. Educators can implement similar approaches by incorporating familiar objects and themes into pre-reading activities, providing multiple sensory learning channels, and maintaining flexible yet structured learning environments.

The success of this intervention suggests that inclusive education practices need not compromise academic rigor. Rather, responsive teaching methods that accommodate diverse learning needs can enhance outcomes for all children while providing essential support for those with attention difficulties. Professional development programs should emphasize the integration of play-based methods with evidence-based literacy instruction to maximize effectiveness for diverse learners.

CONCLUSION

This study demonstrates that play-based contextual learning significantly enhances pre-reading abilities in children at risk for ADHD, with participants achieving substantial improvements from baseline (27.77-30.55%) to final assessment (83.33-88.88%). The intervention successfully addressed multiple developmental domains simultaneously, improving not only letter recognition and phonological awareness but also executive function skills including attention regulation, inhibition, and behavioral self-control. These findings contribute to the growing body of evidence supporting culturally responsive, multisensory approaches in early childhood education for children with neurodevelopmental differences.

The theoretical contribution of this research lies in demonstrating the practical application of constructivist and sociocultural learning theories within inclusive educational settings. By integrating familiar cultural materials (vegetables) with structured play activities, the intervention created meaningful learning contexts that facilitated both cognitive and social-emotional development. The study extends understanding of how contextual teaching and learning principles can be effectively adapted for children with attention difficulties, supporting the multiple cognitive deficit hypothesis while providing practical intervention strategies.

Implications for practice include the need for professional development programs that equip early childhood educators with play-based pedagogical skills, particularly for serving children with diverse learning needs. The intervention's success suggests that inclusive classrooms can effectively support children at risk for learning difficulties without requiring separate specialized programs, provided that teaching approaches are appropriately adapted and culturally responsive.

However, limitations include the small sample size (n=2) and brief intervention duration (one month), which restrict generalizability and assessment of long-term effects. The reliance on observational rather than standardized assessment tools also introduces potential measurement concerns. Future research should examine intervention effectiveness across larger, more diverse populations and explore optimal dosage and sustainability of improvements. Additionally, investigations incorporating family and community components could enhance understanding of systemic factors supporting positive outcomes for children with attention difficulties in early literacy development.

REFERENCES

Addi-Raccah, A., & Grinshtain, Y. (2016). Teachers' capital and relations with parents: A comparison between Israeli Jewish and Arab teachers. *Teaching and Teacher Education*, *60*, 44–53. https://doi.org/10.1016/j.tate.2016.08.004

Altemeier, L. E., Abbott, R. D., & Berninger, V. W. (2008). Executive functions for reading and writing in typical literacy development and dyslexia. *Journal of Clinical and Experimental Neuropsychology*, *30*, 588–606.

Aro, M. (2004). *Learning to read: The effect of orthography*. Jyväskylän yliopisto.

Biederman, J., Monuteaux, M. C., Doyle, A. E., Seidman, L. J., Wilens, T. E., Ferrero, F., Morgan, C. L., & Faraone, S. V. (2004). Impact of executive function deficits and attention-deficit/hyperactivity disorder (ADHD) on academic outcomes in children. *Journal of Consulting and Clinical Psychology*, *72*, 757–766.

Biederman, J., Petty, C. R., Fried, R., Fontanella, J., Doyle, A. E., Seidman, L. J., & Faraone, S. V. (2006). Impact of psychometrically defined deficits of executive functioning in adults with attention deficit hyperactivity disorder. *American Journal of Psychiatry*, *163*, 1730–1738.

Birgisdottir, F., Gestsdottir, S., & Thorsdottir, F. (2015). The role of behavioral self-regulation in learning to reading: A 2-year longitudinal study of Icelandic preschool children. *Early Education and Development*, *26*, 807–828.

Bleses, D., Jensen, P., Højen, A., Slot, P., & Justice, L. M. (2021). Implementing toddler interventions at scale: The case of "We learn together". *Early Childhood Research Quarterly*, *57*, 12–26.

Bleses, D., Jensen, P., Højen, A., Willemsen, M. M., Slot, P., & Justice, L. M. (2024). Examining the effects of an infant-toddler school readiness intervention in center- and family-based programs: Are results generalizable? *Early Childhood Research Quarterly*, *67*(2), 252–264.

Boada, R., Willcutt, E. G., & Pennington, B. F. (2012). Understanding the comorbidity between dyslexia and attention-deficit/hyperactivity disorder. *Topics in Language Disorders*, *32*, 264–284.

Booth, J. N., Boyle, J. M., & Kelly, S. W. (2010). Do tasks make a difference? Accounting for heterogeneity of performance of children with reading difficulties on tasks of executive function: Findings from a meta-analysis. *British Journal of Developmental Psychology*, *28*, 133–176.

Butterfuss, R., & Kendeou, P. (2018). The role of executive functions in reading comprehension. *Educational Psychology Review*, *30*, 801–826.

Carretti, B., Borella, E., Cornoldi, C., & De Beni, R. (2009). Role of working memory in explaining the performance of individuals with specific reading comprehension difficulties: A meta-analysis. *Learning and Individual Differences*, *19*, 246–251.

Catts, H. W., Gillispie, M., Leonard, L. B., Kail, R. V., & Miller, C. A. (2002). The role of speed of processing, rapid naming, and phonological awareness in reading achievement. *Journal of Learning Disabilities*, *35*, 509–524.

Choudhury, N., & Benasich, A. A. (2011). Maturation of auditory evoked potentials from 6 to 48 months: Prediction to 3 and 4 year language and cognitive abilities. *Clinical Neurophysiology*, *122*(2), 320–338. https://doi.org/10.1016/j.clinph.2010.05.035

Christopher, M. E., Hulslander, J., Byrne, B., Samuelsson, S., Keenan, J. M., Pennington, B., DeFries, J. C., Wadsworth, S. J., Willcutt, E., & Olson, R. K. (2015). Genetic and environmental etiologies of the longitudinal relations between prereading skills and reading. *Child Development*, *86*(2), 342–361. https://doi.org/10.1111/cdev.12295

Cutting, L. E., Materek, A., Cole, C. A., Levine, T. M., & Mahone, E. M. (2009). Effects of fluency, oral language, and executive function on reading comprehension performance. *Annals of Dyslexia*, *59*, 34–54.

Dankiw, K. A., Tsiros, M. D., Baldock, K. L., & Kumar, S. (2020). The impacts of unstructured nature play on health in early childhood development: A systematic review. *PLoS One*, *15*(2), e0229006. https://doi.org/10.1371/journal.pone.0229006

Daucourt, M. C., Schatschneider, C., Connor, C. M., Al Otaiba, S., & Hart, S. A. (2018). Inhibition, updating working memory, and shifting predict reading disability symptoms in a hybrid model: Project KIDS. *Frontiers in Psychology*, *9*, 238.

Davtyan, R. (2014). Contextual learning. In *2014 ASEE Zone 1 Conference*.

Doyle, A. E. (2006). Executive functions in attention-deficit/hyperactivity disorder. *Journal of Clinical Psychiatry*, *67*, 21–26.

Doyle, A. E., Faraone, S. V., Seidman, L. J., Willcutt, E. G., Nigg, J. T., Waldman, I. D., Pennington, B. F., Peart, J., & Biederman, J. (2005). Are endophenotypes based on measures of executive functions useful for molecular genetic studies of ADHD? *Journal of Child Psychology and Psychiatry*, *46*, 774–803.

Doyle, C., Smeaton, A. F., Roche, R., & Boran, L. (2018). Inhibition and updating, but not switching, predict developmental dyslexia and individual variation in reading ability. *Frontiers in Psychology*, *9*, 795.

DuPaul, G. J., Gormley, M. J., & Laracy, S. D. (2013). Comorbidity of LD and ADHD: Implications of DSM-5 for assessment and treatment. *Journal of Learning Disabilities*, *46*, 43–51.

Ejuu, G. (2019). African indigenous games: Using Bame Nsamenang's Africentric thoughts to reflect on our heritage, pedagogy, and practice in a global village. *Journal of Psychology in Africa*, *26*(4), 319–327.

Epstein, J. L., & Sanders, M. G. (2002). Family, school, and community partnership. In M. H. Bornstein (Ed.), *Handbook of parenting: Practical issues in parenting* (2nd ed., pp. 407–437). Lawrence Erlbraum Associates.

Fair, D. A., Bathula, D., Nikolas, M. A., & Nigg, J. T. (2012). Distinct neuropsychological subgroups in typically developing youth inform heterogeneity in children with ADHD. *Proceedings of the National Academy of Sciences of the United States of America*, *109*, 6769–6774.

Farrell, A., Taylor, C., & Tennent, L. (2004). Building social capital in early childhood education and care: An Australian study. *British Educational Research Journal*, *30*(5), 623–632.

Gallagher, A., Frith, U., & Snowling, M. J. (2000). Precursors of literacy delay among children at genetic risk of dyslexia. *Journal of Child Psychology and Psychiatry*, *41*(2), 203–213.

Hämäläinen, J., Landi, N., Loberg, O., Lohvansuu, K., Pugh, K., & Leppänen, P. H. T. (2018). Brain event-related potentials to phoneme contrasts and their correlation to reading skills in school-age children. *International Journal of Behavioral Development*, *42*(3), 357–372. https://doi.org/10.1177/0165025417728582

Hayes, N., O' Toole, L., & Halpenny, A. M. (2017). *Introducing Bronfenbrenner: A guide for practitioners and students in early years education*. Routledge.

Helland, T., & Morken, F. (2016). Neurocognitive development and predictors of L1 and L2 literacy skills in dyslexia: A longitudinal study of children 5–11 years old. *Dyslexia*, *22*(1), 3–26. https://doi.org/10.1002/dys.1515

Hindman, A. H., Skibbe, L. E., Miller, A., & Zimmerman, M. (2010). Ecological contexts and early learning: Contributions of child, family, and classroom factors during head start, to literacy and mathematics growth through first grade. *Early Childhood Research Quarterly*, *25*(2), 235–250. https://doi.org/10.1016/j.ecresq.2009.11.003

Hull, D. (1995). *Who are you calling stupid? The revolution that's changing education*. Cord Communications.

Johnstone, A., Martin, A., Cordovil, R., Fjørtoft, I., Iivonen, S., Jidovtseff, B., Lopes, F., Reilly, J. J., Thomson, H., Wells, V., & McCrorie, P. (2022). Nature-based early childhood education and children's social, emotional and cognitive development: A mixed-methods systematic review. *International Journal of Environmental Research and Public Health*, *19*(10), 5967.

Jurado, M. B., & Rosselli, M. (2007). The elusive nature of executive functions: A review of our current understanding. *Neuropsychology Review*, *17*, 213–233.

Keung, P. C., & Cheung, C. K. (2019a). Towards holistic supporting of play-based learning implementation in kindergartens: A mixed method study. *Early Childhood Education Journal*, *47*(5), 627–640. https://doi.org/10.1007/s10643-019-00956-2

Kibby, M. Y., Newsham, G., Imre, Z., & Schlak, J. E. (2021). Is executive dysfunction a potential contributor to the comorbidity between basic reading disability and attention-deficit/hyperactivity disorder? *Child Neuropsychology*, *27*(7), 888–910.

Kirby, J. R., Parrila, R. K., & Pfeiffer, S. L. (2003). Naming speed and phonological awareness as predictors of reading development. *Journal of Educational Psychology*, *95*(3), 453–464. https://doi.org/10.1037/0022-0663.95.3.453

Kuhl, P. K. (2004). Early language acquisition: Cracking the speech code. *Nature Reviews Neuroscience*, *5*(11), 831–843. https://doi.org/10.1038/nrn1533

Kujala, T., Partanen, E., Virtala, P., & Winkler, I. (2023). Prerequisites of language acquisition in the newborn brain. *Trends in Neurosciences*, *46*(9), 726–737. https://doi.org/10.1016/j.tins.2023.05.011

Laasonen, M., Leppämäki, S., Tani, P., & Hokkanen, L. (2009). Adult dyslexia and attention deficit disorder in Finland—Project DyAdd: WAIS-III cognitive profiles. *Journal of Learning Disabilities*, *42*, 511–527.

Lambek, R., Rannock, R., Dalsgaard, S., Trillingsgaard, A., Damm, D., & Thomsen, P. H. (2010). Validating neuropsychological subtypes of ADHD: How do children with and without an executive function deficit differ? *Journal of Child Psychology and Psychiatry*, *51*, 895–904.

Landerl, K., Ramus, F., Moll, K., Lyytinen, H., Leppänen, P. H. T., Lohvansuu, K., O'Donovan, M. C., Williams, J., Bartling, J., Bruder, J., Kunze, S., Neuhoff, N., Streicher, B., Lyytinen, P., Poikkeus, A.-M., Niemi, P., Bakker, M., Fraga González, G., Žarić, G., ... Schulte-Körne, G. (2013). Predictors of developmental dyslexia in European orthographies with varying complexity. *Journal of Child Psychology and Psychiatry*, *54*(6), 686–694. https://doi.org/10.1111/jcpp.12029

Leppänen, P. H. T., Hämäläinen, J. A., Salminen, H. K., Eklund, K. M., Guttorm, T. K., Lohvansuu, K., Puolakanaho, A., & Lyytinen, H. (2010). Newborn brain event-related potentials revealing atypical processing of sound frequency and the subsequent association with later literacy skills in children with familial dyslexia. *Cortex*, *46*(10), 1362–1376. https://doi.org/10.1016/j.cortex.2010.06.003

Locascio, G., Mahone, E. M., Eason, S. H., & Cutting, L. E. (2010). Executive dysfunction among children with reading comprehension deficits. *Journal of Learning Disabilities*, *43*, 441–454.

Lohvansuu, K., Hämäläinen, J. A., Ervast, L., Lyytinen, H., & Leppänen, P. H. T. (2018). Longitudinal interactions between brain and cognitive measures on reading development from 6 months to 14 years. *Neuropsychologia*, *108*, 6–12. https://doi.org/10.1016/j.neuropsychologia.2017.11.018

Lonergan, A., Doyle, C., Cassidy, C., MacSweeney Mahon, S., Roche, R. A. P., Boran, L., & Bramham, J. (2019). A meta-analysis of executive functioning in dyslexia with consideration of the impact of comorbid ADHD. *Journal of Cognitive Psychology*, *31*, 725–749.

Lyytinen, H., Erskine, J., Tolvanen, A., Torppa, M., Poikkeus, A.-M., & Lyytinen, P. (2006). Trajectories of reading development: A follow-up from birth to school age of children with and without risk for dyslexia. *Merrill-Palmer Quarterly*, *52*(3), 514–546. https://doi.org/10.1353/mpq.2006.0031

Madondo, F., & Tsikira, J. (2021). Traditional children's games: Their relevance on skills development among rural Zimbabwean children age 3–8 years. *Journal of Research in Childhood Education*, *36*(3), 406–420.

Matafwali, B., & Mofu, M. (2023). Exploring the feasibility of outdoor indigenous games and songs to enhance play-based pedagogy in early childhood education. *Journal of Childhood, Education & Society*, *4*(3), 391–405.

Mattfeld, A., Whitfield-Gabrieli, S., Biederman, J., Spencer, T., Brown, A., & Gabrieli, J. D. E. (2015). Dissociation of working memory impairments and attention-deficit/hyperactivity disorder in the brain. *NeuroImage: Clinical*, *10*, 274–282.

McClelland, M. M., Cameron, C. E., Duncan, D., Bowles, R. P., Acock, A. C., Miao, A., & Pratt, M. E. (2014). Predictors of early growth in academic achievement: The head-toes-knees-shoulders task. *Frontiers in Psychology*, *5*, 599.

McGrath, L. M., Pennington, B. F., Shanahan, M. A., Santerre-Lemmon, L. E., Barnard, H. D., Willcutt, E. G., DeFries, J. C., & Olson, R. K. (2011). A multiple deficit model of reading disability and

attention-deficit/hyperactivity disorder: Searching for shared cognitive deficits. *Journal of Child Psychology and Psychiatry*, *52*, 547–557.

Mitra, R., Moore, S. A., Gillespie, M., Faulkner, G., Vanderloo, L. M., Chulak-Bozzer, T., Rhodes, R. E., Brussoni, M., & Tremblay, M. S. (2020). Healthy movement behaviours in children and youth during the COVID-19 pandemic: Exploring the role of the neighbourhood environment. *Health & Place*, *65*, 102418. https://doi.org/10.1016/j.healthplace.2020.102418

Moll, K., Ramus, F., Bartling, J., Bruder, J., Kunze, S., Neuhoff, N., Streicher, B., Lyytinen, H., Leppänen, P. H. T., Lohvansuu, K., Tóth, D., Honbolygó, F., Csépe, V., Bogliotti, C., Iannuzzi, S., Démonet, J.-F., Longeras, E., Valdois, S., George, F., ... Schulte-Körne, G. (2014). Cognitive mechanisms underlying reading and spelling development in five European orthographies. *Learning and Instruction*, *29*, 65–77. https://doi.org/10.1016/j.learninstruc.2013.09.003

Moloi, T. J., Mosia, M. S., Matabane, M. E., & Sibaya, K. T. (2021). The use of indigenous games to enhance the learning of word problems in grade 4 mathematics: A case of kgati. *International Journal of Learning, Teaching and Educational Research*, *20*(1), 240–259.

Mostofsky, S. H., Newschaffer, C. J., & Denckla, M. B. (2003). Overflow movements predict impaired response inhibition in children with ADHD. *Perceptual and Motor Skills*, *97*, 1315–1331.

Muir, R. A., Howard, S. J., & Kervin, L. (2024). Supporting early childhood educators to foster children's self-regulation and executive functioning. *Early Childhood Research Quarterly*, *67*, 170–181.

Munsaka, E., & Kalinde, B. (2017). *Laying the foundation for optimal outcomes in early childhood education*. UNZA Press.

Mygind, L., Kjeldsted, E., Hartmeyer, R., Mygind, E., Bolling, M., & Bentsen, P. (2019). Mental, physical and social health benefits of immersive nature-experience for children and adolescents: A systematic review and quality assessment of the evidence. *Health & Place*, *58*, 102136. https://doi.org/10.1016/j.healthplace.2019.05.014

Nakawa, N. (2020). Proposing and modifying guided play on shapes in mathematics teaching and learning for Zambian preschool children. *South African Journal of Childhood Education*, *10*(1), Article a802.

Ng'asike, J. T., & Swadener, B. B. (2019). Promoting indigenous epistemologies in early childhood development policy and practice in pastoralist communities in Kenya. In A.-T. Kjørholt & H. Penn (Eds.), *Early childhood and development work: Theories, policies, and practices* (pp. 113–132). Palgrave Macmillan.

Nigg, J. T., Willcutt, E. G., Doyle, A. E., & Sonuga-Barke, E. J. S. (2005). Causal heterogeneity in attention-deficit/hyperactivity disorder: Do we need neuropsychologically impaired subtypes? *Biological Psychiatry*, *57*, 1224–1230.

Ome, A., & Menendez, A. (2022). Using SMS and parental outreach to improve early reading skills in Zambia. *Education Economics*, *30*(4), 384–398. https://doi.org/10.1080/09645292.2021.1988518

Pascual, A. C., Munoz, N. M., & Robres, A. Q. (2019). The relationship between executive functions and academic performance in primary education: Review and meta-analysis. *Frontiers in Psychology*, *10*, 1582.

Pennington, B. F. (2006). From single to multiple deficit models of developmental disorders. *Cognition*, *101*, 385–413.

Pennington, B. F., & Lefly, D. L. (2001). Early reading development in children at family risk for dyslexia. *Child Development*, *72*(3), 816–833. https://doi.org/10.1111/1467-8624.00317

Pennington, B. F., Santerre-Lemmon, L., Rosenberg, J., MacDonald, B., Boada, R., Friend, A., Leopold, D. R., Samuelsson, S., Byrne, B., Willcutt, E. G., & Olson, R. K. (2012). Individual prediction of dyslexia by single versus multiple deficit models. *Journal of Abnormal Psychology*, *121*, 212–224.

Poljac, E., Simon, S., Ringlever, L., Kalcik, D., Groen, W. B., Buitelaar, J. K., & Bekkering, H. (2010). Impaired task switching performance in children with dyslexia but not in children with autism. *Quarterly Journal of Experimental Psychology*, *63*, 401–416.

Puolakanaho, A., Ahonen, T., Aro, M., Eklund, K., Leppänen, P. H. T., Poikkeus, A., Tolvanen, A., Torppa, M., & Lyytinen, H. (2007). Very early phonological and language skills: Estimating individual risk of reading disability. *Journal of Child Psychology and Psychiatry*, *48*(9), 923–931. https://doi.org/10.1111/j.1469-7610.2007.01763.x

Ray, K., Dally, K., Colyvas, K., & Lane, A. E. (2021). The effects of a whole-class kindergarten handwriting intervention on early reading skills. *Reading Research Quarterly*, *56*, S193–S207. https://doi.org/10.1002/rrq.395

Reiter, A., Tucha, O., & Lange, K. W. (2005). Executive functions in children with dyslexia. *Dyslexia*, *11*, 116–131.

Riazi, N. A., Wunderlich, K., Gierc, M., Brussoni, M., Moore, S. A., Tremblay, M. S., & Faulkner, G. (2021). "You can't go to the park, you can't go here, you can't go there": Exploring parental experiences of COVID-19 and its impact on their children's movement behaviours. *Children*, *8*(3), 219.

Rogers, S. (2010). *Rethinking play and pedagogy in early childhood education: Concepts, contexts and cultures*. Routledge.

Sampa, F. K., Ojanen, E., Westerholm, J., Ketonen, R., & Lyytinen, H. (2018). Literacy programs efficacy for developing children's early reading skills in familiar language in Zambia. *Journal of Psychology in Africa*, *28*(2), 128–135. https://doi.org/10.1080/14330237.2018.1435050

Shanahan, M. A., Pennington, B. F., Yerys, B. E., Scott, A., Boada, R., Willcutt, E. G., Olson, R. K., & DeFries, J. C. (2006). Processing speed deficits in attention deficit/hyperactivity disorder and reading disability. *Journal of Abnormal Child Psychology*, *34*, 584–601.

Shaywitz, S. E., Shaywitz, B. A., Fletcher, J. M., & Escobar, M. D. (1990). Prevalence of reading disability in boys and girls: Results of the Connecticut Longitudinal Study. *Journal of the American Medical Association*, *264*, 998–1002.

Siu, F. Y., & Keung, P. C. (2022a). Developing a culturally based play inventory from the perspectives of Hong Kong parents and children: A content analysis method. *Education*, *50*(7), 868–879. https://doi.org/10.1080/03004279.2021.1915356

Sonuga-Barke, E. J. (2005). Causal models of attention-deficit/hyperactivity disorder: From common simple deficits to multiple developmental pathways. *Biological Psychiatry*, *57*, 1231–1238.

Spencer, L. H., Lynch, M., Lawrence, C. L., & Edwards, R. T. (2020). A scoping review of how income affects accessing local green space to engage in outdoor physical activity to improve well-being: Implications for post-COVID-19. *International Journal of Environmental Research and Public Health*, *17*(24), 9313.

Suryawati, E., & Osman, K. (2017). Contextual learning: Innovative approach towards the development of students' scientific attitude and natural science performance. *Eurasia Journal of Mathematics, Science and Technology Education*, *14*(1), 61–76. https://doi.org/10.12973/ejmste/79329

Tachie, S. A., & Galawe, B. F. (2021). The value of incorporating indigenous games in the teaching of number sentences and geometric patterns. *International Journal for Cross-Disciplinary Subjects in Education*, *12*(1), 4350–4361.

Tamm, L., Denton, C. A., Epstein, J. N., Schatschneider, C., Taylor, H., Arnold, L. E., Bukstein, O., Anixt, J., Koshy, A., Newman, N. C., Maltinsky, J., Brinson, P., Loren, R., Prasad, M. R., Ewing-Cobbs, L., & Vaughn, A. (2017). Comparing treatments for children with ADHD and word reading difficulties: A randomized clinical trial. *Journal of Consulting and Clinical Psychology*, *85*, 434–446.

Tembo, B., Nyimbili, F., Namuyamba, M., & Tambulukani, G. (2018). Teacher utilisation of emergent literacy skills in the teaching of physical education in the primary schools of Lundazi district. *International Journal of Humanities Social Sciences and Education*, *5*(7), 56–63.

Tillmann, S., Tobin, D., Avison, W., & Gilliland, J. (2018). Mental health benefits of interactions with nature in children and teenagers: A systematic review. *Journal of Epidemiology and Community Health*, *72*(10), 958–966. https://doi.org/10.1136/jech-2018-210436

Torppa, M., Lyytinen, P., Erskine, J., Eklund, K., & Lyytinen, H. (2010). Language development, literacy skills, and predictive connections to reading in Finnish children with and without familial risk for dyslexia. *Journal of Learning Disabilities*, *43*(4), 308–321. https://doi.org/10.1177/0022219410369096

Truelove, S., Bruijns, B. A., Vanderloo, L. M., O'Brien, K. T., Johnson, A. M., & Tucker, P. (2018). Physical activity and sedentary time during childcare outdoor play sessions: A systematic review and meta-analysis. *Preventive Medicine*, *108*, 74–85. https://doi.org/10.1016/j.ypmed.2017.12.022

van der Sluis, S., de Jong, P. F., & van der Leij, A. (2007). Executive functioning in children, and its relations with reasoning, reading, and arithmetic. *Intelligence*, *35*, 427–449.

Visser, S. N., Danielson, M. L., Bitsko, R. H., Holbrook, J. R., Kogan, M. D., Ghandour, R. M., Perou, R., & Blumberg, S. J. (2014). Trends in the parent-report of health care provider-diagnosed and medicated attention-deficit/hyperactivity disorder: United States, 2003–2011. *Journal of the American Academy of Child and Adolescent Psychiatry*, *53*, 34–46.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Whitehurst, G. J., & Lonigan, C. J. (1998). Child development and emergent literacy. *Child Development*, *69*(3), 848–872.

Willcutt, E. G., Betjemann, R. S., McGrath, L. M., Chhabildas, N. A., Olson, R. K., DeFries, J. C., & Pennington, B. F. (2010). Etiology and neuropsychology of comorbidity between RD and ADHD: The case for multiple-deficit models. *Cortex*, *46*, 1345–1361.

Willcutt, E. G., Doyle, A. E., Nigg, J. T., Faraone, S. V., & Pennington, B. F. (2005). Validity of the executive function theory of attention-deficit/hyperactivity disorder: A meta-analytic review. *Biological Psychiatry*, *57*, 1336–1346.

Winter, M., & Hollingsworth, H. (2015). Promoting pretend play in the preschool years: Teacher practices and strategies for involving families. *Childhood Education*, *91*(3), 182–189. https://doi.org/10.1080/00094056.2015.1047309

Wodka, E. L., Mahone, E. M., Blankner, J. G., Larson, J. C., Fotedar, S., Denckla, M. B., & Mostofsky, S. H. (2007). Evidence that response inhibition is a primary deficit in ADHD. *Journal of Clinical and Experimental Neuropsychology*, *29*, 345–356.

Wood, E. (2009). Conceptualising a pedagogy of play: International perspectives from theory, policy and practice. In D. Kushner (Ed.), *From children to red hatters: Diverse images and issues of play* (pp. 166–190). University Press of America.