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Original Article

Early childhood social-emotional and cognitive development through associative play stimulation in preschool children with frequent gadget use

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Abstract

Background Rapid increases in gadget exposure among preschool children raise concerns about negative effects on socioemotional and cognitive development. Structured associative play, involving cooperative art and storytelling activities, may counter these impacts by enhancing social interaction among children and engagement with trained facilitators, emotional regulation, and cognitive stimulation. Global recommendations emphasize guided play and parental engagement to mitigate screen-related harms.

Objective To evaluate the effects of a four-week associative play therapy program on socioemotional and cognitive development in preschoolers with frequent gadget use.

Methods A randomized controlled trial was conducted at Kurnia Sari Kindergarten, Surabaya, involving 80 children aged 4-6 years with moderate to high gadget use (≥1 hour/day, parent-reported), who were randomly assigned to an associative play intervention (n=40) or a control group (n=40). The intervention, delivered twice weekly for 30-40 minutes, consisted of collaborative painting, collage making, storytelling, and literacy-based play. Socioemotional and cognitive outcomes were measured using observation tools adapted from the *2013 Indonesian National Curriculum* (CVI=0.86; κ≈0.82). Data were analyzed using independent *t*-tests, with significance set at $P<0.05$.

Results Children receiving associative play therapy demonstrated significantly higher mean socioemotional and cognitive scores compared to the control group (34.85 (SD 3.21) *vs.* 28.40 (SD 3.76), $P<0.001$) and 36.10 (SD 3.04) *vs.* 30.25 (SD 3.59), $P<0.001$), respectively. Both effects were large and clinically meaningful, supporting the efficacy of play-based interventions in early education.

Conclusion A structured four-week associative play therapy significantly enhanced socioemotional and cognitive development among preschool children with moderate to high gadget use (≥1 hour/day). Incorporating associative play into early childhood curricula and community-based child health promotion, along with parental education, may help mitigate potential developmental risks associated with early and frequent gadget use. Parental education is also recommended to foster developmental resilience in the digital age. **[Paediatr Indones. 2026;66:199-207; DOI: https://doi.org/10.14238/pi66.3.2026.199-207].**

Keywords: *associative play; preschool; socioemotional development; cognitive development; screen time; randomized controlled trial*

Early childhood represents a critical period for the development of socioemotional and cognitive capacities that shape lifelong learning, interpersonal relationships, and overall well-being. During the preschool years, children build foundational abilities such as empathy, cooperation, emotional regulation, and problem-solving primarily through active play and social

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interaction. Classic developmental theories, including Piaget's cognitive constructivism and Vygotsky's sociocultural framework, emphasize that play is not merely a leisure activity, but a vital medium through which children internalize rules, negotiate meaning, and develop higher-order thinking skills.[1] Within play-based environments, children learn to share attention, take turns, understand others' perspectives, and express emotions constructively - all of which form the socioemotional core for later academic and social competence.[2,3]

However, the rapid rise of digital technology has reshaped early childhood experiences worldwide. In Indonesia, as in many countries, preschool-aged children are increasingly exposed to gadgets and online media from an early age.[4,5] According to WHO guidelines, children under five should engage in regular physical activity and active play while limiting sedentary screen time (≤1 hour/day), as these behaviors are associated with improved cognitive and psychosocial development.[6] Despite these recommendations, many families in Indonesia report that preschool children spend more than two hours daily on screens, often without structured guidance.[7] This trend underscores the need for interventions that reintroduce cooperative, creative play as a counterbalance to digital dependency.

A growing body of evidence indicates that excessive gadget use in early childhood is linked to emotional dysregulation, attention difficulties, and poorer peer interaction.[7] This suggests that digital media exposure may both reflect and reinforce emotional challenges, creating a feedback loop detrimental to socioemotional growth. From a developmental standpoint, socioemotional skills are shaped through dynamic peer interaction and guided play experiences. When play is replaced by extended screen time, it may impede cognitive development by displacing activities that are essential for children's learning and development.[8] In this context, structured play-based interventions have emerged as promising strategies to restore developmental balance, offering children the chance to engage meaningfully with peers and adults.[9,10] This study was grounded in socio-constructivist and play-based learning theories, which posit that cognitive and emotional development arise through socially mediated interactions. Vygotsky's concept of the zone of proximal development explains how children achieve higher levels of learning through guidance and support from more knowledgeable others, including peers and adults.[11]

Associative play, a semi-structured form of cooperative activity, aligns well with this theory. It involves children working on shared creative tasks such as painting, storytelling, or construction, promoting both independence and interdependence.[12,13] Evidence suggests that structured peer play improved empathy, self-control, and cooperative behavior.[14] Malaysian preschoolers who participated in a socioemotional competence module developed stronger social cooperation and emotional literacy.[15] These studies reinforce the idea that creative, cooperative play nurtures interpersonal relationships and strengthens children's capacity for empathy and emotional regulation, skills increasingly compromised by excessive digital media exposure. Cognitive development is also positively influenced by play. Play-based tasks engage executive functions such as working memory, cognitive flexibility, and inhibitory control, which form the foundation for school readiness and adaptive learning.[16,17] Recent studies further validated these mechanisms by showing that rhythmic, socially interactive play enhanced inhibitory control and working memory;[18] linked free play to greater self-directed attention;[19] and found that cognitively engaging physical games improved executive function through simultaneous motor and mental activation.[20] These findings provide a robust theoretical foundation for implementing associative play as a holistic approach that strengthens both socioemotional and cognitive domains.

Despite international recognition of play as a cornerstone of early learning, structured play-based interventions remain underutilized in Indonesian preschool settings. Rapid urbanization and increasing exposure to digital technology have been associated with changes in children's lifestyles, reducing opportunities for traditional and cooperative play.[21,22] Although national curricula in Indonesia advocate play-based learning (*Permendikbud No. 146/2014*), many preschools still face challenges in implementing structured, guided play due to limited facilities,[23] and insufficient teacher preparedness.[24] Several regional studies suggest that play interventions could mitigate the negative consequences of screen exposure. For instance, Studies in Indonesia have shown that play

activities involving peer interaction can enhance cooperation and social interaction among preschool children.[25] Similarly, Fauziah *et al.*[26] reported that play-based routines improved sleep and behavioral regulation in preschoolers during and after the COVID-19 pandemic, emphasizing the benefits of play on resilience. Yet, robust experimental trials that examine both socioemotional and cognitive outcomes in the context of gadget use remain scarce in Indonesia. Given this gap, there is an urgent need for evidence-based, culturally adaptable strategies to balance digital engagement with social play. Integrating associative play into preschool curricula could serve as a preventive and developmental tool, fostering emotional resilience and cognitive agility. Aligning with UNICEF's (2021) call to promote digital well-being through guided play, we explored the role of structured associative play therapy as a practical response to the developmental challenges posed by frequent gadget use among preschool-aged children. Building upon this theoretical and empirical foundation, we aimed to evaluate the effect of a four-week associative play therapy program on socioemotional and cognitive development among preschool children with frequent gadget exposure. Specifically, the study objectives were to assess the effectiveness of associative play therapy in improving socioemotional development and examine the impact of associative play therapy on cognitive development.

Methods

This randomized, controlled, pre-post trial was conducted at Kurnia Sari Kindergarten, Surabaya, East Java, Indonesia, between March and June 2025. The protocol followed the CONSORT 2010 guidelines for randomized controlled trials27. Ethical approval was obtained from the *Institutional Review Board of the Chakra Brahmanda Lentera Institution* (Ref: 034/09/VI/EC/KEP/LCBL/2025). Parents or legal guardians provided written informed consent prior to participation.

Children aged 4-6 years who attended the kindergarten regularly and whose parents reported moderate to high daily gadget exposure (≥ 1 hour/day on average) were eligible. Exclusion criteria included diagnosed neurodevelopmental disorders, chronic medical conditions that could affect participation, or inability to attend at least 75% of sessions. A convenience sample of 89 children was screened; after applying eligibility criteria, 80 participants were randomized into the intervention (n=40) or the control (n=40) groups. Randomization was done with a computer-generated sequence with stratification by age (4, 5, and 6 years) and gender to ensure balanced groups. An a priori power calculation ($\alpha=0.05$, power $=0.8$) indicated that 34 participants per group would detect a moderate effect (Cohen's $d \approx 0.65$); 40 per group allowed for potential attrition and the detection of larger effects. No structured assessment of home environment quality or parental engagement was collected at baseline.

The intervention comprised a structured associative play therapy program delivered by trained early-childhood facilitators, adapted from Parten's associative play theory12 and previous art- and play-based intervention studies.[13,27] Participants were preschool children with average gadget exposure of ≥1 hour/day. Previous reports indicate that many preschool-aged children exceed WHO recommendations for screen time exposure.[4,6] Sessions lasted 30-40 minutes, twice weekly, for four weeks (eight sessions total), including guided collaborative activities and group reflection. Sessions lasted 30-40 minutes, twice weekly, for four weeks (eight sessions total). Each session followed a structured format consisting of a brief introduction (5-10 minutes), a guided collaborative activity (20-25 minutes), and a short reflection and closing discussion (5 minutes). This corresponded to a total cumulative exposure of approximately 4-5 hours of structured associative play across the four-week intervention period. Content followed weekly themes as follows:

- Week 1 (flora and fauna): collaborative painting and collage; group storytelling.
- Week 2 (underwater life): guided drawing, co-created storyboards, and literacy tasks (letter recognition through themed materials).
- Week 3 (professions and vehicles): role-play prompts integrated with mixed-media collage and cooperative problem-solving activities.
- Week 4 (child-chosen free theme): child-led collaborative projects fostering initiative and planning.

Facilitators followed standardized operating

procedures (SOPs) developed by the research team, adapted from art therapy principles and creative drawing activities described in previous studies, and used session checklists to ensure intervention fidelity.[28] Approximately 20% of sessions were observed by a supervisor to assess adherence and provide feedback. The intervention structure emphasized cooperative tasks, shared materials, and scaffolded adult prompts designed to enhance turn-taking, narrative construction, and emotion labelling. All intervention activities were conducted in Bahasa Indonesia to ensure age-appropriate communication and comprehension among participants.

Control-group children participated in the kindergarten's standard curriculum activities, including storytelling, singing, and worksheet-based tasks, aligned with the *Indonesian National Early Childhood Education Curriculum* (*Permendikbud* No. 146/2014). These activities were matched in duration and frequency with the intervention sessions but were primarily teacher-directed and non-associative, with less emphasis on peer collaboration.

Socioemotional and cognitive development were assessed using observation sheets adapted from the *2013 Indonesian National Curriculum* (*Permendikbud* No.146/2014). Items measured socioemotional indicators (cooperation, sharing, emotional regulation, empathy, turn-taking, conflict resolution) and cognitive indicators (attention, memory, symbolic thinking, early literacy, problem-solving). The instruments were selected to ensure contextual and cultural alignment with classroom-based developmental indicators commonly applied in Indonesian preschool settings, thereby enhancing ecological validity within the study environment. While internationally standardized developmental assessments such as the WPPSI-IV or NEPSY provide broader normative benchmarks, their constructs may not fully reflect the curriculum-based competencies emphasized in local early childhood education frameworks.

Content validity (CVI=0.86) was established via two local early-childhood education experts before the main trial, after the observation instruments were drafted and prior to participant recruitment; inter-rater reliability was evaluated with two independent raters (κ=0.82 for the socioemotional domain; κ=0.79 for the cognitive domain), indicating acceptable methodological rigor.

Observation scoring produced continuous composite scores for each domain. Baseline observations were completed by trained assessors who were blinded to group allocation, meaning they did not know whether a child belonged to the intervention or control group. After the intervention, post-test assessments were conducted by independent raters who were not involved in the intervention sessions, using the same standardized scoring procedure to ensure objectivity and reduce bias.

Data were recorded on standardized forms and entered into *SPSS version 26.0* software. Data cleaning included checks for outliers and plausibility. Missing data were minimal (<3%) and addressed with pairwise deletion for the primary analyses. Given the trial's randomized design and adequate group sizes, independent t-tests were used to compare post-intervention scores between the two groups for each domain (socioemotional and cognitive). Baseline (pre-intervention) scores were compared between groups to ensure initial equivalence. Changes in scores from pre- to post-intervention were examined descriptively within each group, while between-group differences in post-intervention scores were analyzed using independent T-tests. Tests were two-tailed; assumptions of normality and homogeneity of variances were evaluated via Shapiro-Wilk and Levene's tests, respectively. Where assumptions were violated, equivalent nonparametric checks (Mann-Whitney U) were conducted as sensitivity analyses; these consistently supported the parametric findings. Effect sizes (Cohen's d) and 95% confidence intervals were computed to quantify magnitude. Statistical significance was set at P<0.05.

Results

Baseline demographic characteristics are presented in **Table 1**. The intervention and control groups were comparable in age, gender distribution, and daily gadget use (all P>0.05).

Table 2 shows that the intervention and control groups did not differ significantly at baseline in socioemotional score [27.95 (SD 3.82) *vs.* 28.20 (SD 3.67); P=0.78]. After the intervention, the intervention group had a significantly higher

socioemotional score than the control group (34.85 (SD 3.21) vs. 28.40 (SD 3.76); mean difference=6.45, 95% CI 4.80 to 8.10; P<0.001; effect size=1.65). These findings indicate a large between-group effect in favor of the intervention. Because this table compares groups at each time point, within-group change should be reported separately using change scores or paired analyses. Children in the intervention group demonstrated enhanced sharing, turn-taking, emotion labelling, and cooperative problem-solving.

Table 3 shows that mean baseline cognitive scores were comparable between the intervention and control groups [29.15 (SD 3.45) *vs.* 29.05 (SD 3.52); P=0.92]. Following the intervention, the intervention group demonstrated significantly higher cognitive scores than the control group [36.10 (SD 3.04) *vs.* 30.25 (SD 3.59)], with a mean difference of 5.85 (95% CI 3.90 to 7.80; P<0.001) and a large effect size=1.44). These findings indicate a substantial between-group difference in favor of the intervention. As the analysis reflects between-group comparisons at each time point, the observed results should be interpreted alongside separate analyses of within-group changes.

No adverse events were reported during or after the intervention sessions (**Table 4**). The program demonstrated high adherence, with a mean attendance of 7.6 (SD 0.6) out of 8 sessions. Observational data indicated that most participants were actively engaged during sessions. Based on facilitator observations, approximately 95% of children participated actively and appeared to enjoy the activities.

Parent feedback suggested positive perceptions of the intervention, with 90% rating the program as

Table 1. Participants' characteristics

Characteristics	Intervention (n=40)	Control (n=40)	P value
Mean age (SD), years	5.02 (0.63)	5.08 (0.61)	0.67[a]
Gender, n (%)			0.82[b]
Male	21 (52.5)	20 (50.0)	
Female	19 (47.5)	20 (50.0)	
Mean daily gadget use (SD), hours	2.9(1.1)	2.8(1.0)	0.67[a]

Table 2. Comparison of pre-test and post-test socioemotional development scores between groups

Measures	Intervention group (n=40)	Control group (n=40)	Mean difference (95% CI)	Effect size	P value
Mean pre-test socioemotional score (SD)	27.95 (3.82)	28.20 (3.67)	-0.25 (-1.75 to 1.25)		0.78
Mean post-test socioemotional score (SD)	34.85 (3.21)	28.40 (3.76)	6.45 (4.80 to 8.10)	1.65	<0.001

Table 3. Comparison of pre-test and post-test cognitive development scores between groups

Measures	Intervention group (n=40)	Control group (n=40)	Mean difference (95% CI)	Effect size	P value
Mean pre-test socioemotional score (SD)	29.15 (3.45)	29.05 (3.52)	0.10 (-1.30 to 1.50)	0.78	0.92
Mean post-test socioemotional score (SD)	36.10 (3.04)	30.25 (3.59)	5.85 (3.90 to 7.80)	1.44	<0.001

Table 4. Safety and acceptability of the intervention

Parameter	Observation
Adverse events	No adverse events were reported during or after intervention sessions
Attendance [mean (SD)]	7.6 ± 0.6 sessions out of 8 (95% adherence)
Participant engagement	~95% of children actively participated (based on facilitator observation)
Parental feedback	90% of parents rated the program as "very useful" or "useful" in feedback forms
Facilitator feedback	Reported ease of implementation and good engagement

"useful" or "very useful." Facilitators also reported that the intervention was feasible to implement within routine classroom settings, requiring minimal additional resources. These findings suggest that the associative play intervention was safe and feasible, with generally positive acceptability among participants and stakeholders.

Discussion

This randomized trial revealed that a brief, structured associative play therapy program produced substantial improvements in both socioemotional and cognitive development among preschool children with frequent gadget exposure. The effects were large and statistically significant, indicating that guided peer play is a promising kindergarten-based strategy. However, the present study did not measure whether gadget use changed after the intervention. Therefore, the findings should not be interpreted as evidence that screen time decreased or that the intervention directly removed the effects of gadget exposure. A more cautious interpretation is that associative play provided an enriched social-learning context that was beneficial even in children who had frequent daily gadget exposure.

The pronounced gains in socioemotional functioning corroborate existing evidence that play serves as a social scaffold fostering empathy, cooperation, and emotional regulation. During associative play, children engage in social interaction processes such as communication, cooperation, negotiation, and collaborative problem-solving, which contribute to the development of empathy and self-regulation.[14,28] These interaction-based processes are consistent with Vygotsky's socio-constructivist framework, which emphasizes the role of guided social interaction in children's development within the zone of proximal development.[11]

Comparable findings have been reported in the region, where structured play and guided play programs produced measurable gains in children's peer interaction, emotional regulation, and social competence; for example, a controlled play intervention demonstrated improvements in preschoolers' social and emotional skills, and larger systematic reviews of Asian studies reported consistent benefits of play-based approaches for socioemotional development.[2,3] Internationally, a review of twenty years of findings of evidence-based interventions of the "Game Program" in Spain found that cooperative-creative play significantly enhanced peer interaction, emotional stability, and prosocial behavior in young children, providing empirical support for structured peer play enhancing emotional literacy.[14] This finding was echoed in Malaysia,[15] where a socio-emotional competence module significantly improved preschoolers' social cooperation and emotional literacy, even in populations with elevated screen exposure, which has been linked to reduced social reciprocity.[7]

Our study also demonstrated significant improvements in cognitive scores among children who participated in the associative play intervention. This outcome aligns with a growing body of literature emphasizing that play, whether free, cooperative, or structured, serves as a critical driver of executive function development in early childhood. Executive functions, encompassing working memory, cognitive flexibility, and inhibitory control, underpin goal-directed learning, problem-solving, and school readiness.[31] A comparative study of executive function development during the transition from the first to the second cycle of early childhood education revealed that the maturation of executive processes is not solely age-dependent, but is strongly influenced by educational contexts that promote interaction, symbolic play, and problem-solving.[16] Similarly, a study found that cooperative learning environments significantly predicted improvements in children's inhibitory control and cognitive flexibility across one academic year, demonstrating that social collaboration acts as a mediator in executive growth.[17]

The cognitive benefits of play are also recognized in pediatric and developmental literature. A policy statement for the *American Academy of Pediatrics* titled "The Power of Play" emphasized that play is not a leisure activity but a foundational mechanism through which children acquire and integrate cognitive skills.[1] Playful learning enhances executive function by encouraging planning, hypothesis testing, and adaptive thinking. These skills are essential for navigating complex tasks.[1]

These findings are corroborated by studies exploring specific forms of play and physical

engagement. Free play activities were reportedly significantly associated with higher executive function performance, particularly in self-directed attention and cognitive flexibility, compared with more passive or adult-led routines.[19] Likewise, a previous study provided experimental evidence that "exergames," digital games requiring physical movement, enhanced executive function through simultaneous cognitive engagement and physical intensity. Children who played exergames requiring decision-making and coordination exhibited significant gains in inhibitory control compared to those engaging in low-cognitive physical activity.[20] Furthermore, a randomized controlled trial examining an early childhood dancesport intervention found that structured rhythmic movement improved both working memory and inhibitory control. Cognitively demanding motor activities combining rhythm, coordination, and social cooperation can promote prefrontal activation and executive function efficiency in preschoolers.[18]

Together, these studies elucidate the mechanisms underlying the present findings: associative play integrates social cooperation, goal-directed action, and emotion regulation, where each is critical for executive function development. The primary analyses were conducted using composite domain scores for socioemotional and cognitive development rather than separate statistical testing of individual indicators. Each domain was constructed by aggregating multiple interrelated components (e.g., cooperation, emotional regulation, attention, and problem-solving) to capture holistic developmental functioning. Accordingly, references to specific behaviors in this discussion reflect the conceptual structure of the instrument rather than subcomponent-level statistical comparisons. The significant post-test gains observed in our intervention were, therefore, consistent with evidence that structured, cognitively engaging play contexts stimulate neural circuits supporting working memory and self-regulation.[17,18] The results strengthen the case for incorporating guided play as an educational and therapeutic tool to enhance cognitive readiness and adaptive learning in early childhood.

The differences observed between the intervention and control groups may be explained by the structured and interactive nature of associative play activities. Children in the intervention group were repeatedly encouraged to participate in communication, emotional expression, turn-taking, cooperation, and collaborative problem-solving during peer-play sessions. These activities may have strengthened socioemotional competencies while simultaneously stimulating attention, cognitive flexibility, and self-regulation, which are important components of early cognitive development. In contrast, children in the control group continued routine classroom activities without structured associative play stimulation, which may explain the smaller improvements observed in developmental outcomes.

Beyond statistical significance, the large effect sizes observed in this trial indicate clinically and educationally meaningful gains in preschool settings. Notably, these improvements were achieved with only 4-5 hours of structured associative play over four weeks, highlighting the intervention's efficiency. Observable enhancements in emotional regulation, peer cooperation, attention, and early literacy readiness have direct implications for classroom functioning and school readiness. From a public health perspective, these findings are particularly relevant in populations with high levels of early childhood screen exposure. Structured associative play represents a feasible, low-cost preventive approach that can be integrated into routine kindergarten programs to support psychosocial and developmental well-being at the community level.

Limitations include the relatively short follow-up period (four weeks of intervention with only an immediate post-test), which precludes conclusions regarding the long-term sustainability of developmental gains. Although the observational instruments demonstrated acceptable validity and reliability, they were adapted from the national curriculum framework and, therefore, lack the external standardization of widely used developmental assessments (e.g., WPPSI-IV, NEPSY). This may limit the direct comparability of effect magnitudes with studies conducted in other international contexts using standardized neurocognitive tools. Consequently, caution is warranted when generalizing the findings beyond similar educational and cultural settings. The single-site setting in Surabaya may limit generalizability to different cultural or socioeconomic contexts. However, evidence from Indonesian studies indicates that screen exposure among preschool

children is consistently high across regions, with many exceeding recommended usage levels.4 Finally, while randomization balanced measured variables, unmeasured confounders such as home environment quality or parental engagement outside school could have influenced outcomes. Baseline data on average daily gadget exposure, as reported by parents, were collected; however, structured assessments of home learning environment or parenting practices were not formally administered. Future research should incorporate validated instruments, such as the *Home Observation for Measurement of the Environment* (HOME) inventory or structured parental engagement questionnaires, to better isolate intervention effects and adjust for potential confounding influences.

In conclusion, a structured, four-week associative play therapy program delivered twice weekly produced large, statistically significant improvements in both socioemotional and cognitive development among preschool children with moderate to high gadget use (≥1 hour/day. These results support integrating associative play into early-childhood curricula and community-based child-health promotion as a pragmatic strategy to offset potential developmental risks associated with early and frequent gadget exposure.

A longitudinal extension of our trial is planned with follow-up assessments within 6-12 months post-intervention to evaluate the sustainability of socioemotional and cognitive gains and to examine whether booster sessions enhance maintenance effects. Comparative studies contrasting associative play with other interventions (parent-mediated home programs, digital educational apps) would clarify comparative effectiveness. Implementation research is also needed to evaluate fidelity, scaling, and cost-effectiveness in diverse Indonesian settings. Finally, future studies should incorporate standardized direct neurocognitive assessments alongside observational developmental measures, as well as structured assessments of family media exposure and parental engagement. The inclusion of these variables could strengthen causal inference and clarify the neurodevelopmental and environmental mechanisms underlying observed outcomes.

Conflict of interest

None declared.

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