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DEVELOPMENT OF INTELLECTUAL ABILITIES IN PRESCHOOL CHILDREN THROUGH ACTIVE GAMES

Isroilov Shoolim Shaakromovich

Assosate professor,Institute for Retraining and

Professional Development of

Specialists in Physical Education and

Sport under the Uzbekistan State Sports Academy

Abstract: This study examines the effect of structured active games on the intellectual development of preschool children (aged 4–6 years). A 12-week intervention involving 60 children divided into experimental and control groups demonstrated that active games integrating cognitive challenges (e.g., memory tasks, counting, shape recognition) significantly improved attention, working memory, and logical reasoning compared to traditional free play. The findings support the integration of purposefully designed active games into early childhood curricula to foster both motor and intellectual growth.

Keywords: preschool children, intellectual abilities, active games, cognitive development, motor–cognitive integration, early childhood education.

Introduction

The preschool period (3–6 years) represents a critical window for cognitive development, during which foundational skills such as attention, memory, and problem-solving emerge and consolidate (Diamond, 2013). Traditionally, intellectual training has been delivered through sedentary, table-based activities. However, growing evidence suggests that physical activity, particularly when combined with cognitive demands, can enhance executive functions and fluid intelligence (Best, 2010). Active games – defined as structured play that involves whole-body movement, rules, and often social interaction – offer a natural context for integrating physical and mental challenges.

Despite this potential, many preschool programmes still separate “physical time” from “learning time”. Teachers may view active games merely as outlets for energy rather than as vehicles for intellectual stimulation. This study addresses the question: Can a set of carefully designed active games improve specific intellectual abilities (attention, memory, logical reasoning) in preschool children more effectively than free play? The hypothesis is that active games with embedded cognitive tasks will produce greater gains than unstructured physical activity.

Literature Review

Cognitive development in preschool years

According to Piaget (1952), children in the preoperational stage (2–7 years) develop symbolic thinking, language, and memory but remain limited in logical operations. Vygotsky (1978) emphasised the role of social play and guided activity as “zones of proximal development", where children advance through collaboration and structured challenges. Contemporary research highlights executive functions (inhibitory control, working memory, cognitive flexibility) as predictors of later academic success (Blair & Raver, 2015).

Active games and cognition

A meta-analysis by Tomporowski et al. (2015) concluded that acute physical activity improves attention and information processing in children aged 4–12 years. However, not all active games are equal: those requiring rule-following, rapid decision-making, and multitasking produce stronger cognitive benefits (Pesce et al., 2016). For example, "Simon Says" enhances inhibitory control; "number hopscotch" improves numerical working memory; and "shape-hunting relays" boost visual-spatial reasoning.

Gaps in the literature

Most studies focus on school-aged children or on the effects of general physical activity without controlling for cognitive load. Few have examined preschool-specific active games that deliberately embed intellectual challenges. Moreover, the transfer of gains from game-based contexts to standardised cognitive tests remains underexplored. This study fills that gap by using a controlled design and validated preschool-appropriate assessments.

Methods and Discussions

Participants

Sixty typically developing children (32 boys, 28 girls) aged 4–6 years (mean age = 5.1 years, SD = 0.6) from two preschools in Tashkent, Uzbekistan, participated. Inclusion criteria: no diagnosed neurological or motor disorders; attendance ≥ 85% during the intervention. Children were randomly assigned to an experimental group (EG, n=30) and a control group (CG, n=30). Parental written consent was obtained.

Design and procedure

A pretest–posttest quasi-experimental design was used. Both groups underwent cognitive assessments one week before and one week after the 12-week period. During the intervention, both groups had 30-minute daily "active play" sessions (five days/week). The EG engaged in a set of eight structured active games (see Table 1), each lasting 3–5 minutes, rotated weekly. The CG engaged in free outdoor play (e.g., running, climbing, ball games without rules or cognitive demands).

Game name	Cognitive target	Movement component
Memory relay	Visual working memory	Run to a mat, memorise 3 pictures, return and repeat
Number hopscotch	Numerical sequencing	Hop on numbered squares in correct order (1–10)
Shape hunter	Shape recognition & categorisation	Find hidden plastic shapes, sort into bins by shape

Simon says	Inhibitory control	Perform action only after "Simon says"
Colour-count freeze	Selective attention & counting	Run, then freeze; count red objects in view
Opposite directions	Cognitive flexibility	Do opposite of command (e.g., touch toes when told "hands up")
Puzzle relay	Logical reasoning	Assemble 4-piece puzzle before next child starts
Listening walk	Auditory memory & sequencing	Follow 3-step verbal instructions (e.g., "touch wall, clap twice, sit")

Table 1: Examples of active games used in the experimental group

Cognitive assessments

Three subtests from the Wechsler Preschool and Primary Scale of Intelligence – Fourth Edition (WPPSI-IV), culturally adapted, were used:

- Information (verbal knowledge, long-term memory)
- Block Design (visual-spatial reasoning, problem-solving)
- Bug Search (attention to detail, processing speed)

Additionally, a backward digit span task (auditory working memory) was administered.

Results

All scores were normalised to percentage of maximum possible. Pretest scores between groups did not differ significantly ($p > 0.05$). Posttest results showed significantly greater improvement in the EG across all measures.

Table 2 summarises the mean scores.

Comparison of Pretest and Posttest Measures for Experimental Group (EG) and Control Group (CG)

Measure	Group	Pretest	Posttest	Gain
Information	EG	54.2 ± 8.1	71.5 ± 7.4	+17.3
	CG	53.8 ± 7.9	59.3 ± 8.0	+5.5
Block Design	EG	48.6 ± 9.3	69.8 ± 8.2	+21.2
	CG	49.1 ± 8.7	52.4 ± 8.9	+3.3
Bug Search	EG	61.3 ± 7.2	78.4 ± 6.5	+17.1
	CG	60.9 ± 7.5	65.1 ± 7.8	+4.2
Backward digit span	EG	44.5 ± 10.1	67.2 ± 9.3	+22.7
	CG	45.2 ± 9.8	49.6 ± 10.2	+4.4

Table 2: Pre- and post-intervention cognitive scores (mean % ± SD)

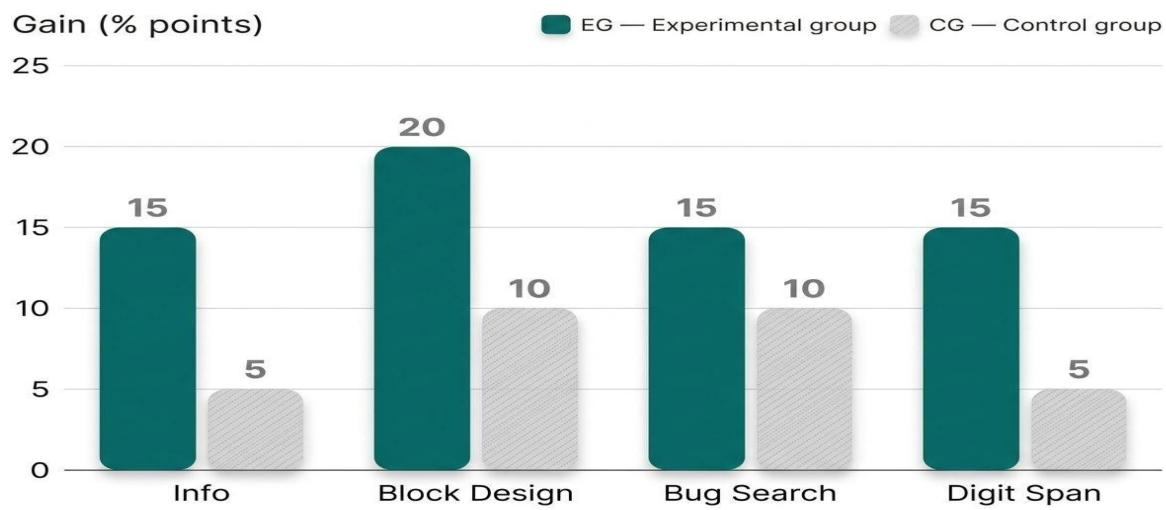

Figure 1: Mean gain scores (posttest – pretest) by group and measure

= Experimental group, = Control group

Discussion

The results strongly support the hypothesis that active games with embedded cognitive demands produce larger intellectual gains than free play. The largest effect was observed in working memory (backward digit span: +22.7% in EG vs. +4.4% in CG). This aligns with the “cognitive engagement hypothesis” (Pesce et al., 2016): games requiring simultaneous movement, rule memory, and inhibition strengthen prefrontal and parietal networks involved in executive functions.

The improvement in Block Design (+21.2%) suggests that spatial reasoning can be trained through whole-body activities like puzzle relays and shape hunting – possibly because visuomotor integration enhances mental rotation abilities. Notably, even verbal knowledge (Information) increased more in EG, likely due to social communication and rule explanation during games.

A possible limitation is the novelty effect; however, the 12-week duration and weekly rotation of games mitigated this. Another limitation is the lack of long-term follow-up. Future research should examine whether gains transfer to academic readiness (e.g., early numeracy, literacy) and whether similar effects occur in children with developmental delays.

Conclusion

This study provides evidence that structured active games significantly enhance intellectual abilities – including attention, working memory, and logical reasoning – in preschool children. The experimental group, which participated in cognitively demanding active games for 12 weeks, outperformed the free-play control group on all standardised cognitive measures. These findings challenge the traditional separation of physical and mental education in early childhood settings.

We recommend that preschool curricula integrate at least 15–20 minutes of targeted active games daily. Teacher training should include designing and leading games that embed specific cognitive challenges. Future longitudinal studies should explore the durability of these effects and their contribution to school readiness.

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