BG Pulse Journal USA
ISSN:1947-2536 http://www.bgpulseusa.com/index.php/bg

TECHNOLOGY FOR DEVELOPING COGNITIVE ACTIVITY OF PRESCHOOL CHILDREN BASED ON A DIGITAL LEARNING ENVIRONMENT

Qalandarova Bakhtigul Ozod qizi
Teacher of the Department of Preschool Education
bakhtigulqal@gmail.com

Abdurakhmonova Shahlo
Student of the Department of Preschool Education

Abstract The rapid advancement of digital technologies has transformed educational practices, offering new opportunities to enhance cognitive development in preschool children. This article explores the integration of digital learning environments—such as interactive apps, tablets, smartboards, and adaptive platforms—into preschool education to foster cognitive activity, including attention, memory, problem-solving, logical thinking, and metacognition. Drawing on theoretical foundations from Piaget and Vygotsky, as well as empirical studies, it examines benefits, implementation strategies, potential risks, and best practices. Evidence indicates that well-designed digital tools, when combined with guided adult interaction and play-based activities, significantly boost cognitive skills, particularly in personalized and interactive settings. The discussion emphasizes balanced approaches in contexts like Uzbekistan, where national reforms promote digital integration while preserving traditional play. Recommendations include teacher training, age-appropriate content, and hybrid models to maximize positive outcomes.

Keywords: cognitive activity, preschool children, digital learning environment, educational technology, interactive apps, metacognition, early childhood education, Uzbekistan preschool reforms.

Introduction Cognitive activity in preschool children (typically ages 3–7) refers to the active mental processes involved in perception, attention, memory, thinking, imagination, and problem-solving. This period is critical for foundational brain development, as children transition from sensorimotor and preoperational stages (per Piaget) to more symbolic and logical thinking. Lev Vygotsky's sociocultural theory further highlights the role of social interactions, scaffolding by more knowledgeable adults or peers, and cultural tools (including digital ones) in the Zone of Proximal Development (ZPD).

In the digital age, traditional play-based learning is increasingly augmented by technology. Digital learning environments encompass interactive whiteboards, educational apps (e.g., for literacy and numeracy), gamified platforms, coding toys, and AI-driven adaptive tools. These provide multisensory, personalized experiences that can accelerate cognitive growth. Globally, preschool enrollment and digital access have grown, with countries like Uzbekistan investing heavily through projects like the World Bank's Promoting Early Childhood Development and the "Digital Uzbekistan 2030" strategy.

This article synthesizes international and local (Uzbek) research to argue that thoughtfully implemented digital technologies can enhance cognitive activity without replacing hands-on play.

Main Part Theoretical Foundations Jean Piaget described preschoolers in the preoperational stage (2–7 years) as developing symbolic thought, language, and imaginative play, though limited

by egocentrism and lack of conservation. Digital tools can support this by offering visual representations and simulations that aid symbolic understanding. Vygotsky emphasized mediation through tools and social interaction; digital devices act as modern cultural tools that extend the ZPD when used collaboratively.

Benefits of Digital Learning Environments Research shows positive impacts on cognitive domains:

- **Attention and Memory**: Interactive apps with adaptive difficulty improve sustained attention and working memory. Educational content (e.g., PBS Kids-style programs) enhances letter sounds and counting more effectively than passive viewing.
- **Problem-Solving and Logical Thinking**: Gamification and coding apps (e.g., simple robotics or block-based programming) foster logical reasoning and computational thinking. Studies report gains in analytical skills and metacognition.
- **Creativity and Executive Function**: Multimedia storytelling and drawing apps encourage creative expression and self-regulation.

In Uzbekistan, studies highlight improvements in cognitive skills through digital tools. For instance, Shaxnoza Nuritdinova's research on 6–7-year-olds demonstrates that integrating computer programs and digital resources raises cognitive skill levels in preschool groups. Other Uzbek works emphasize raqamli texnologiyalar (digital technologies) for developing bilish faolligi (cognitive activity) and kasbiy qiziqishlar (professional interests).

Implementation Strategies Effective integration involves:

1. **Age-Appropriate Design**: Short sessions (15–30 minutes), high-quality educational content, and co-use with teachers/parents.
2. **Blended Learning**: Combine digital with hands-on activities, aligning with Uzbekistan's play-based curriculum reforms.
3. **Teacher Role**: Educators scaffold via Vygotskian methods, using interactive whiteboards for group discussions.
4. **Tools**: Tablets for personalized apps, smartboards for collaborative learning, and AI for adaptive feedback.

Empirical examples include quasi-experimental studies where critical thinking via digital/problem-based tasks increased high cognitive activity from 12% to 50% in preschoolers.

Challenges and Risks Excessive or passive screen time can impair attention, self-regulation, or social skills, especially under age 2 or with poor content. Digital divides in rural areas, data privacy, and the need to maintain physical play are concerns. In Uzbekistan, infrastructure and teacher training remain priorities.

Discussion Digital environments amplify cognitive development when quality, moderation, and integration are prioritized. They align with constructivist theories by enabling active, scaffolded exploration. Uzbek research [e.g., Nuritdinova, 2025] and international findings converge on benefits for literacy, numeracy, and executive functions, particularly in diverse or remote settings via mobile kindergartens with digital components.

However, technology is a tool, not a panacea. Over-reliance risks reducing social interaction or creativity. Balanced hybrid models—digital for personalization, traditional for embodiment—yield optimal results, as supported by blended learning studies. Cultural adaptation is key; in Uzbekistan, aligning with "Ilk Qadam" curriculum ensures relevance.

Future research should track long-term outcomes, especially in low-resource contexts.

Conclusion and Suggestions Digital learning environments offer powerful means to develop cognitive activity in preschool children, enhancing readiness for formal schooling and 21st-century

skills. Evidence from global and Uzbek studies confirms gains in key areas when implemented thoughtfully.

Suggestions:

- Develop national guidelines for digital content in Uzbekistan preschools.
- Provide ongoing teacher training in digital pedagogy and scaffolding.
- Promote parent involvement and screen-time limits.
- Invest in inclusive access (e.g., mobile/digital kits for rural areas).
- Conduct longitudinal studies on cognitive impacts.
- Foster public-private partnerships for high-quality, localized apps.

By embracing these technologies responsibly, educators can nurture curious, capable young minds.

References

1. Clemente-Suárez, V.J. et al. (2024). Digital Device Usage and Childhood Cognitive Development. PMC.
2. Nuritdinova, Sh. (2025). 6–7 yoshli bolalarning kognitiv ko‘nikmalarini raqamli ta’lim vositalari asosida shakllantirish metodikasini takomillashtirish. Maktabgacha va maktab ta’limi jurnali. (Uzbek source).
3. Tuzdybayeva, A. et al. (2025). Development of cognitive activity in preschool children through critical thinking technology. International Journal of Innovative Research and Scientific Studies, 8(3).
4. Vygotsky, L.S. (1978). Mind in Society. Harvard University Press. (Classic, pages on ZPD: e.g., 84–91).
5. Piaget, J. (1950s works; e.g., The Psychology of Intelligence). Preoperational stage details.
6. World Bank reports on Uzbekistan ECD (2020s). Preschool enrollment and innovations.
7. Karunaratne et al. (2025). Utilizing Digital Technology to Support Child Cognitive Development. Thesis.