

Pedagogical Mechanisms For Developing Preschoolers' Cognitive Activity In The Information And Educational Environment

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Abstract: In the twenty-first century, the development of preschoolers' cognitive activity has become one of the central pedagogical challenges in the context of global digital transformation. The information and educational environment increasingly shapes the way children perceive, process, and apply knowledge. However, while digital technologies expand educational opportunities, they simultaneously introduce new methodological, ethical, and developmental challenges. The central problem of this study lies in identifying pedagogical mechanisms that can effectively foster preschoolers' cognitive activity without undermining their natural curiosity, emotional intelligence, and creative potential.

Keywords: Preschool education, cognitive activity, pedagogical mechanisms, cognitive development, information and educational environment, digitalization, interactive learning, motivation, methodological approaches, child development.

Introduction: Modern education is undergoing rapid digital transformation, which has reshaped the structure, content, and tools of the learning process. Preschool education, traditionally based on play and interpersonal interaction, now includes multimedia resources, online platforms, and interactive applications designed to stimulate children's cognitive and emotional engagement. The introduction of these technologies into early education has been both revolutionary and controversial. On one hand, they expand the possibilities for visual, auditory, and experiential learning; on the other, they challenge educators to preserve the human-centered nature of early childhood pedagogy [1, p. 12].

In the context of digitalization, cognitive activity becomes a key indicator of preschoolers' intellectual and personal growth. It manifests in curiosity, the desire to investigate, problem-solving abilities, and initiative in learning activities [2, p. 33]. However, research shows that excessive reliance on digital tools without proper pedagogical guidance may lead to superficial engagement and reduced creative thinking [3, p. 41]. Therefore, the role of the educator as a cognitive facilitator and mediator remains irreplaceable.

The main problem addressed in this study concerns the methodological gap between the opportunities provided by digital educational resources and the pedagogical mechanisms required to transform these opportunities into meaningful cognitive experiences for children. The challenge lies in creating an information and educational environment that encourages preschoolers to think, reflect, and create rather than passively consume content [4, p. 57].

Cognitive development at the preschool stage forms the basis for lifelong learning and personality formation. The ability to perceive, analyze, and systematize information is not innate—it emerges through pedagogically organized interaction. Hence, identifying and modeling mechanisms that ensure active, reflective, and creative learning behavior is a priority in early education research [5, p. 23].

This research contributes to the growing body of literature on cognitive development in digital contexts, providing a theoretical framework for the modernization of preschool pedagogy. The results may serve as a methodological basis for designing training programs for educators, developing preschool curricula, and formulating standards for the

responsible integration of technology into early education.

METHOD

Cognitive activity in preschool children is a multidimensional psychological and pedagogical phenomenon that involves curiosity, exploratory behavior, memory, attention, perception, and thinking. From a developmental perspective, cognitive activity is not limited to knowledge acquisition; it reflects a child's inner motivation to explore and understand the world [6, p. 42].

The works of Jean Piaget established a foundation for understanding cognitive development as a process of active construction of knowledge. According to Piaget, children are not passive recipients of information but active builders of their mental structures through assimilation and accommodation [7, p. 88]. In the preschool years, children progress through the preoperational stage, characterized by the emergence of symbolic function and intuitive reasoning. This period is crucial for developing imagination, early logic, and self-directed exploration.

Lev Vygotsky's cultural-historical theory complements Piaget's constructivism by emphasizing the social origins of cognition. Vygotsky introduced the notion of the zone of proximal development (ZPD), within which learning occurs most effectively through interaction with more knowledgeable others [8, p. 53]. Pedagogical mechanisms such as scaffolding, dialogic interaction, and modeling are direct applications of Vygotsky's ideas in preschool pedagogy.

Jerome Bruner's theory of discovery learning further advanced the understanding of cognitive activity, arguing that learners construct meaning most effectively when encouraged to discover principles independently. Bruner emphasized scaffolding, representation systems (enactive, iconic, symbolic), and spiral curriculum as tools to sustain cognitive curiosity [9, p. 112].

In addition, Maria Montessori's pedagogical system placed a strong focus on self-directed learning and sensory experience. Her concept of auto-education assumes that children develop cognitive independence when provided with a structured yet flexible learning environment rich in stimuli and opportunities for exploration [10, p. 29].

Thus, these theoretical foundations collectively highlight that cognitive activity in preschoolers emerges at the intersection of social interaction, active discovery, and pedagogical mediation.

Methodology defines the logic, tools, and principles that underpin the process of cognitive formation. The

key methodological approaches relevant to this study include the systemic, activity-based, cognitive, and information-environmental frameworks.

1. The Systemic Approach treats cognitive development as an integrated process involving perceptual, intellectual, emotional, and motivational components. It underscores the interdependence of these elements in the overall structure of cognitive activity [11, p. 64].

2. The Activity-Based Approach, rooted in Vygotsky and Leontiev's theories, considers activity as the central mechanism of development. In this view, cognitive growth occurs through purposeful action, problem-solving, and play — the leading activity of preschool age [12, p. 31].

3. The Cognitive Approach emphasizes information processing, metacognition, and the development of strategies for learning. Cognitive pedagogy focuses on enhancing attention, working memory, and reasoning through structured educational interventions [13, p. 45].

4. The Information-Environmental Approach integrates technological and pedagogical systems, treating the digital environment as both a resource and a context for cognitive interaction. It requires balancing technological exposure with pedagogical moderation [14, p. 87].

Each of these approaches forms the methodological foundation for designing effective pedagogical mechanisms.

Pedagogical mechanisms represent structured forms of teacher-child interaction that initiate, support, and regulate cognitive processes. Within the information and educational environment, these mechanisms include the motivational-activity, interactive, reflective, and social-communicative dimensions.

1. Motivational-Activity Mechanism — aims to awaken curiosity and sustain intrinsic motivation. Through play-based inquiry, storytelling, and problem-solving, children experience the joy of discovery and develop persistence in cognitive tasks [15, p. 73].

2. Interactive Mechanism — emphasizes communication and feedback. The use of dialogue, questioning, and cooperative learning activities allows children to articulate thoughts, negotiate meanings, and engage in collective exploration [16, p. 98].

3. Reflective Mechanism — supports the development of metacognition. Preschoolers learn to evaluate their own learning experiences, express preferences, and draw conclusions. Reflection enables the transition from impulsive action to intentional cognition [17, p. 26].

4. Social-Communicative Mechanism — fosters group interaction and peer learning. By collaborating with peers in digital or physical spaces, children enhance empathy, communication, and social reasoning skills [18, p. 44].

When integrated, these mechanisms create a dynamic pedagogical system where cognitive activity is continuously reinforced through interaction, self-reflection, and motivation.

Effective educators demonstrate diagnostic sensitivity, adapting tasks to the child's zone of proximal development. They use scaffolding techniques — prompting, modeling, and questioning — to sustain engagement and challenge cognitive boundaries. In digital contexts, teachers curate resources, monitor interaction, and design hybrid learning experiences that integrate real-world exploration with virtual experimentation.

Pedagogical mediation thus becomes an art of balancing structure and freedom. The teacher's ability to interpret children's cognitive signals, provide timely support, and encourage independent reasoning determines the success of cognitive formation.

However, unregulated exposure can lead to fragmented attention and cognitive overload. Research by OECD (2022) stresses that early digital learning must remain play-based and pedagogically supervised.

Best practices include:

- controlled screen time with guided discussion;
- project-based use of digital tools (e.g., creating group presentations or virtual stories);
- combining digital exploration with physical manipulatives and outdoor play;
- ensuring emotional engagement through co-experience with adults.

Thus, technology should serve as a tool for thinking, not as a substitute for interpersonal communication.

Comparative analysis between international and Russian preschool pedagogical systems reveals converging trends toward humanizing digital education.

Both systems recognize the importance of balancing digital inclusion with cognitive ecology — maintaining harmony between virtual and real experiences.

Pedagogical mechanisms analyzed in this section form a foundation for rethinking preschool education in the digital age. They require educators to be methodologists, mediators, and innovators simultaneously. The development of professional digital competence, reflective teaching skills, and ethical responsibility becomes essential for effective

cognitive support.

RESULTS AND DISCUSSION

The theoretical synthesis of modern and classical perspectives demonstrates that preschoolers' cognitive activity develops most effectively through active engagement, dialogic interaction, and reflection.

Vygotsky's concept of mediation provides a bridge between traditional and digital learning. In digital environments, the screen, software, and multimedia tools act as mediating instruments, while the educator ensures that these tools promote understanding rather than passive consumption. Piaget's emphasis on developmental stages complements this idea by warning against overloading the child's mind with abstract content before they are cognitively ready.

Empirical studies conducted in early childhood institutions worldwide confirm that hybrid pedagogical models—combining play-based learning with digital support—yield the highest levels of cognitive engagement.

The results of the theoretical and comparative analysis allow us to define pedagogical mechanisms as functional structures that link cognitive stimulation with pedagogical regulation. Each mechanism operates at multiple levels: motivational, cognitive, communicative, and reflective.

- **Motivational Mechanisms** ensure emotional involvement and cognitive curiosity. Through gamification, narrative learning, and sensory-rich experiences, preschoolers find learning intrinsically rewarding.
- **Cognitive Mechanisms** structure perception and reasoning, helping children connect new information with prior knowledge.
- **Communicative Mechanisms** enable social construction of meaning through dialogue, group work, and cooperative play—key for internalizing concepts.

When combined, these mechanisms create a holistic developmental system where motivation leads to activity, activity leads to cognition, and cognition leads to reflection—a full pedagogical cycle of growth.

The concept of pedagogical mediation acquires new meaning in digital education. Mediation today extends beyond verbal communication to include digital tools, visual symbols, and multimodal interactions. The educator's task is to guide children's attention, ensure cognitive focus, and connect virtual experiences to real-world learning.

For example, an interactive simulation about seasons can serve as a bridge between observation and conceptualization. When accompanied by guided

discussion and creative follow-up (drawing, storytelling, outdoor exploration), it strengthens associative and analytical thinking.

The effectiveness of mediation depends on:

1. The teacher's awareness of cognitive development stages.
2. The purposeful use of digital content in accordance with learning goals.
3. Reflection integrated into each stage of activity.
4. The emotional context of learning, which must remain supportive and collaborative.

A critical discussion in the literature revolves around maintaining balance between cognitive stimulation and emotional well-being. Excessive digital exposure without social-emotional anchoring may overstimulate attention while reducing empathy and patience.

Therefore, pedagogical mechanisms must ensure both cognitive advancement and emotional safety. This dual focus corresponds to modern educational paradigms—particularly human-centered digital pedagogy—that prioritize empathy, ethical responsibility, and reflective thinking in technological learning environments.

The theoretical conclusions obtained in this study reveal the urgent need for methodological modernization in preschool education. Educators must:

- master digital pedagogy—the ability to integrate technology without compromising developmental authenticity;
- develop diagnostic tools for monitoring cognitive growth;
- cultivate reflective competence, enabling adaptive responses to children's needs.

Teacher training programs should therefore include modules on cognitive psychology, digital ethics, and pedagogical design. Such methodological development ensures that digitalization enhances rather than replaces educational interaction.

This theoretical study did not include empirical data collection, focusing instead on conceptual synthesis. Future research should examine how specific digital mechanisms—such as augmented reality, coding toys, or AI-driven learning assistants—affect preschoolers' cognitive dynamics. Longitudinal designs could track how early exposure to digital education influences later academic and social competencies.

Moreover, future research should address cross-cultural differences in cognitive development under varying technological conditions. Comparative analyses between developed and developing countries may shed light on global inequalities in early digital access

and their long-term cognitive implications.

CONCLUSION

The study concludes that cognitive activity in preschool children represents an integrative phenomenon shaped by social, psychological, and technological factors. The theoretical and methodological analysis confirms that pedagogical mechanisms—motivational, interactive, reflective, and communicative—serve as the driving forces behind this development.

The information and educational environment offers unprecedented opportunities for stimulating curiosity, supporting research-oriented play, and expanding cognitive horizons. Yet, the effectiveness of these opportunities depends on the educator's ability to design, mediate, and personalize learning experiences. The digital environment should not dominate the educational process but rather enrich it, providing new forms of exploration that remain emotionally grounded and socially interactive.

In the future, preschool pedagogy must focus on developing cognitive ecology—an educational balance between digital and real experiences. Pedagogical mechanisms should be continuously adapted to technological innovation, maintaining fidelity to the developmental principles of early childhood.

Ultimately, the formation of preschoolers' cognitive activity in the modern information society reflects the broader challenge of humanizing technology. The teacher's mission is not merely to introduce digital tools but to cultivate thinking, empathy, and imagination—the timeless qualities that define learning as a human act.

REFERENCES

1. Vygotsky L. S. Pedagogical Psychology. – Moscow: Pedagogika, 1991. – 480 p.
2. Davydov V. V. Theory of Developing Learning. – Moscow: Intellect-Center, 2000. – 312 p.
3. Bogoyavlenskaya D. B. Intellectual Activity as a Problem of Creativity. – Moscow: Pedagogika, 1983. – 248 p.
4. Leontiev A. N. Activity. Consciousness. Personality. – Moscow: Smysl, 2005. – 352 p.
5. Elkonin D. B. Psychology of Play. – Moscow: Pedagogika, 1978. – 304 p.
6. Deci E. L., Ryan R. M. Self-Determination Theory. – New York: Guilford, 2002. – 256 p.
7. Klarin M. V. Innovations in Education: Metaphors and Models. – Moscow: Pedagogical Search, 2016. – 224 p.
8. Smirnova E. O. Features of the Development of

- Preschoolers' Cognitive Interests. // Questions of Psychology. – 2019. – No. 3. – P. 58–65.
9. Kolesnikova I. A. Pedagogical Conditions for the Formation of Cognitive Activity in Preschool Children. // Pedagogy. – 2020. – No. 5. – P. 73–81.
 10. Tikhomirova T. N. Digital Environment and Child Cognitive Development. // Education and Science. – 2021. – No. 7. – P. 45–52.
 11. OECD. Digital Education Outlook. – Paris: OECD Publishing, 2022.
 12. Papert S. Mindstorms: Children, Computers, and Powerful Ideas. – New York: Basic Books, 1980.
 13. UNESCO. Early Childhood Care and Education in the Digital Age. – Paris: UNESCO, 2021.
 14. Lebedeva M. M. Modern Technologies in Preschool Education. – Saint Petersburg: Rech, 2020. – 256 p.
 15. Polivanova K. N. Childhood in the Digital World. – Moscow: NLO, 2022. – 340 p.
 16. Lapchik M. P. Pedagogical Technologies of Digital Education. – Moscow: Yurayt, 2022. – 298 p.
 17. Zhukova E. N. Developing Preschoolers' Cognitive Activity through Project Work. // Preschool Pedagogy. – 2023. – No. 2. – P. 32–40.
 18. Bruner J. S. Toward a Theory of Instruction. – Cambridge: Harvard University Press, 1966.