

EDUCATIONAL TECHNOLOGIES AND METHODS AIMED AT DEVELOPING THINKING PROCESSES IN PRESCHOOL CHILDREN

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Abstract. This article provides a broad and systematic analysis of modern educational technologies and methods aimed at developing thinking processes in preschool-aged children, including visual-active thinking, visual-figurative thinking, and the early forms of logical thinking. The psychological, pedagogical, and neuropsychological foundations of thinking development, the internal and external factors influencing its formation, age-specific characteristics, and specific methodological approaches used in practice are examined in detail. These approaches include problem-based learning, systems of didactic games, project-based technology, construction and modeling activities, and logical-mathematical tools. The article also discusses the role of educators and families in this process, the dual influence of the digital environment, and methods for diagnosing the development of thinking. The article concludes with practical recommendations based on theoretical analysis.

Keywords: thinking, preschool age, cognitive development, educational technologies, didactic games, problem-based learning.

MAKTABGACHA YOSHDAGI BOLALARDA TAFAKKUR JARAYONLARINI RIVOJLANTIRISHGA YO'NALTIRILGAN TA'LIM TEXNOLOGIYALARI VA METODLARI

Annotatsiya. Mazkur maqolada maktabgacha yoshdagi bolalarda tafakkur jarayonlarini, jumladan, ko'rgazmali-harakatli tafakkur, ko'rgazmali-obrazli tafakkur hamda mantiqiy tafakkurning dastlabki shakllarini rivojlantirishga yo'naltirilgan zamonaviy ta'lim texnologiyalari va metodlari keng hamda tizimli tahlil qilinadi. Tafakkur rivojlanishining psixologik, pedagogik va neyropsixologik asoslari, uning shakllanishiga ta'sir etuvchi ichki va tashqi omillar, yoshga xos xususiyatlar hamda amaliyotda qo'llaniladigan metodik yondashuvlar batafsil yoritiladi. Jumladan, muammoli ta'lim, didaktik o'yinlar tizimi, loyihaviy ta'lim texnologiyasi, konstruksiyalash va modellashirish faoliyati, mantiqiy-matematik vositalarning ahamiyati ochib beriladi. Shuningdek, mazkur jarayonda tarbiyachi va oilaning roli, raqamli muhitning ikki tomonlama ta'siri hamda tafakkur rivojlanishini diagnostika qilish usullari ko'rib chiqiladi. Maqola nazariy tahlil asosida ishlab chiqilgan amaliy tavsiyalar bilan yakunlanadi.

Kalit so'zlar: tafakkur, maktabgacha yosh, kognitiv rivojlanish, ta'lim texnologiyalari, didaktik o'yinlar, muammoli ta'lim.

ОБРАЗОВАТЕЛЬНЫЕ ТЕХНОЛОГИИ И МЕТОДЫ, НАПРАВЛЕННЫЕ НА РАЗВИТИЕ ПРОЦЕССОВ МЫШЛЕНИЯ У ДЕТЕЙ ДОШКОЛЬНОГО ВОЗРАСТА

Аннотация. В данной статье представлен широкий и систематический анализ современных образовательных технологий и методов, направленных на развитие мыслительных процессов у детей дошкольного возраста - наглядно-действенного, наглядно-образного мышления и начальных форм логического мышления. Подробно освещаются психолого-педагогические и нейropsychологические основы развития мышления, внутренние и внешние факторы, влияющие на его формирование, возрастные особенности, а также конкретные методические подходы, применяемые на практике (метод проблемного обучения, система дидактических игр, технология проектной деятельности, конструкторская и моделирующая деятельность, логико-математические средства). Кроме того, рассматриваются роль воспитателя и семьи в данном процессе, двустороннее влияние цифровой среды, а также методы диагностики развития мышления. Статья завершается практическими рекомендациями, разработанными на основе теоретического анализа.

Ключевые слова: мышление, дошкольный возраст, когнитивное развитие, образовательные технологии, дидактическая игра, проблемное обучение.

Introduction. In the modern education system, the purposeful development of an individual's intellectual potential from an early age is becoming increasingly important. Over recent decades, interest in cognitive development during early childhood has increased significantly in global pedagogy and psychology. This interest is associated not

only with theoretical considerations but also with practical and social needs. Numerous large-scale longitudinal studies indicate that children who receive high-quality cognitive stimulation during the preschool period subsequently achieve better outcomes in school education, professional activities, and social adaptation. This situation places a responsibility on preschool educational organizations and families to develop children's thinking through scientifically grounded, consistent, and age-appropriate technologies.

The preschool period is one of the most active stages in the formation of children's thinking. It is precisely during this period that the relationships among perception, memory, attention, and thinking reach a new qualitative level. According to L. S. Vygotsky's cultural-historical theory, higher mental functions, including thinking, initially emerge in an external social form through interaction with adults and peers and subsequently become internal, individual mental processes through the process of internalization [1]. The concept of the "zone of proximal development" introduced by Vygotsky occupies a central place in the design of educational technologies: tasks that a child cannot perform independently but can accomplish with the assistance of an adult or through cooperation with a peer contribute directly to the child's development. This principle theoretically explains why technologies used in preschool education should be based on activity, communication, cooperation, and play.

In J. Piaget's theory of cognitive development, preschool age is described as the "preoperational stage" (approximately 2–7 years). During this period, children acquire symbolic thinking: they begin to represent objects through symbols, words, and images; however, they are not yet able to apply logical operations consistently and reversibly. Their thinking remains egocentric, centered on a single feature at a time, and strongly dependent on concrete experience [2]. The studies of D. B. Elkonin and A. V. Zaporozhets, representing the Russian (former Soviet) school of psychology, explain this process through the leading activity of childhood-play. In particular, role-playing games contribute to the development of symbolization, the ability to imagine alternative situations, and the ability to think from another person's perspective [3, 4].

At the same time, the modern digital environment and the increasing use of screen-based technologies from an early age may have both positive and potentially harmful effects on the trajectory of children's thinking development. This issue is increasingly discussed in the scientific literature. Therefore, preschool education specialists need to develop and implement scientifically grounded, systematic, and practice-oriented technologies for developing children's thinking. The relevance of this article lies precisely in this issue: systematizing methods aimed at developing children's thinking from a psychological and pedagogical perspective, revealing the mechanisms underlying each method, and presenting understandable and applicable recommendations for practicing educators and parents.

The purpose of this article is to theoretically systematize modern educational technologies and methods aimed at developing thinking processes in preschool-aged children, analyze their psychological mechanisms, and develop scientifically grounded recommendations for their practical implementation. To achieve this purpose, the following tasks were established: (1) to examine the theoretical and neuropsychological foundations of thinking development; (2) to describe the specific characteristics of thinking development at different age stages; (3) to analyze the main technologies and methods used in practice; (4) to clarify the role of educators and families; and (5) to examine diagnostic methods and formulate final recommendations.

1. Theoretical and Neuropsychological Foundations of Thinking Development

1.1. The Concept of Thinking and Its Structure

Thinking is a generalized and mediated reflection of reality. Unlike sensation and perception, it makes it possible to reveal connections and relationships that are not directly given. Thinking is carried out through the following basic operations: analysis (dividing a whole into parts), synthesis (forming an integrated representation from separate parts), comparison (identifying similarities and differences), abstraction (identifying essential characteristics while disregarding secondary features), generalization (combining similar objects on the basis of common characteristics), and concretization (applying a general rule to a specific situation).

During the preschool period, all of these operations are still in the process of formation. They do not develop independently but rather develop in an interconnected manner within children's activities, including play, observation, communication, and construction.

1.2. Three-Stage Sequence of Thinking Development

During the preschool period, thinking develops through a three-stage sequence:

1. Visual-active thinking (approximately 1–3.5 years) - the child solves problems through direct practical actions with real objects. For example, when trying to open a box, the child may turn it in different directions and find a solution through trial and error. At this stage, thinking exists in close connection with action.

2. Visual-figurative thinking (approximately 3.5–6 years) - the child begins to solve problems through imagined images and schemes without directly manipulating the object. This form of thinking develops actively through play, drawing, and construction activities and contributes to the development of the ability to plan actions internally.

3. Early elements of logical thinking (approximately 6–7 years, the school-readiness period) - initial skills in forming concepts, generalizing, and making simple inductive and elementary deductive conclusions begin to develop. The child becomes capable of understanding cause-and-effect relationships of the "if... then..." type.

These stages do not simply replace one another; rather, they build upon and enrich each other. Even in older children, visual-active and visual-figurative forms of thinking remain present and may become active again when solving complex tasks. Therefore, educational technologies should be selected according to age: at younger ages, greater emphasis

should be placed on practical and object-based activities, while at older ages, symbolic and schematic tools should be increasingly used without completely eliminating practical activity.

1.3. Neuropsychological Foundations

According to A. R. Luria's neuropsychological theory, thinking is realized through the coordinated functioning of three functional blocks of the brain: (1) the energetic block responsible for maintaining tone and alertness; (2) the block responsible for receiving, processing, and storing information, primarily involving the posterior regions of the brain; and (3) the block responsible for programming, regulating, and controlling activity, primarily involving the frontal regions [5].

During the preschool period, the maturation of the frontal regions is not yet complete. This helps explain children's relatively limited ability to voluntarily regulate attention, plan their activities, and exercise self-control. Therefore, technologies aimed at developing thinking should promote not only cognitive functions but also regulatory functions, such as following rules, waiting for one's turn, and completing a task.

1.4. Factors Influencing Thinking Development

The major factors influencing the development of thinking include the following:

Level of speech development - speech serves as both a tool for the formation of thinking and a means of expressing it. As L. S. Vygotsky emphasized, thinking and speech become increasingly interconnected during childhood, forming "verbal thinking" [1].

Quality of communication with adults and peers - question-and-answer interactions, explanations, and discussions contribute to the development of the dialogical nature of thinking.

Diversity of activities - different types of activities, such as play, construction, work, and creative activities, develop different aspects of thinking.

Richness of the educational environment - a developing subject-spatial environment and the availability of various materials and tools create favorable conditions for cognitive development.

Emotional and social well-being - a sense of security and a positive emotional environment increase children's exploratory activity, whereas stress may limit their cognitive resources.

2. Specific Characteristics of Thinking Development by Age

For educational technologies to be designed effectively, the specific characteristics of each age group must be taken into account.

Younger preschool age (3–4 years): Thinking is primarily manifested in its visual-active form. Children learn to compare objects according to color, shape, and size and begin to perform simple grouping tasks. Attention is unstable, and activities tend to be short in duration. During this period, play-based manipulation and work with sensory materials are particularly important.

Middle preschool age (4–5 years): Visual-figurative thinking develops actively. Children frequently ask "why" questions and begin to understand simple cause-and-effect relationships. Role-playing games become more complex, and imaginative activity increases. Didactic games, work with fairy tales, and simple experiments are particularly effective during this period.

Older preschool age (5–6 years): Skills of generalization, classification, and seriation develop actively. Children begin to acquire initial forms of concepts, and elements of logical thinking become apparent. During this period, problem situations, project activities, and elements of TRIZ can be effectively applied.

School-readiness period (6–7 years): The initial, though still unstable, forms of logical thinking become more firmly established. Children become capable of drawing simple conclusions, providing reasons for their opinions, and acting according to rules. Logical-mathematical games, work with schemes and models, and initial elements of educational activity are particularly important during this period.

3. Main Technologies and Methods Aimed at Developing Thinking

3.1. Problem-Based and Inquiry-Oriented Learning Method

Instead of providing a child with a ready-made answer, this method presents a question or situation that encourages independent exploration, such as "Why does ice melt?", "Which object does not sink in water?", or "Why does an umbrella help us when it rains?"

The child formulates a hypothesis, tests it, for example through a simple experiment, and draws a conclusion. This process activates the operations of analysis, synthesis, and comparison.

Problem-based learning can be organized in three stages: (1) creating a problematic situation and ensuring that the child recognizes and accepts it; (2) proposing hypotheses and jointly determining ways to test them; and (3) generalizing the results and drawing conclusions.

The effectiveness of this method depends on the suitability of the questions for the child's age characteristics and on the educator's position-not to provide the "correct answer," but to guide the child toward exploration. Researchers emphasize that problematic situations should neither be too easy nor too difficult for the child; they should fall within the child's "zone of proximal development." Otherwise, the child may lose interest or become confused.

3.2. System of Didactic Games

Didactic games are one of the most natural means of practicing almost all major thinking operations, including comparison, classification, generalization, seriation (ordering according to size or another characteristic), analysis, and synthesis.

Didactic games can conditionally be divided into the following groups:

Object-based games - games involving real objects, toys, and natural materials, such as "Magic Bag" and "Who Can Collect Them Faster?"

Board and printed games - lotto, dominoes, cut-up pictures, and matching games.

Word games - games based exclusively on speech and imagination without relying on objects, such as "What's Extra?", "Who Can Say More Words?", and "Find the Opposite Word."

Games such as "Find the Odd One Out," "Arrange from Largest to Smallest," "Who Lives Where?", and "Whole and Part" develop children's analytical and synthetic thinking.

An important advantage of didactic games is that they rely on intrinsic motivation. The child feels that they are "playing" rather than "being taught," which promotes the natural and stable development of cognitive processes. In addition, because didactic games involve rules, they also develop voluntary attention and self-control, which are directly related to the regulatory functions discussed above from a neuropsychological perspective.

3.3. Project-Based Technology

In preschool education, project-based technology involves children working in small groups to solve practical problems, such as projects on "What Plants Grow in Our Kindergarten?" or "Where Does Water Come From?"

During this process, children go through stages of asking questions, collecting information through observation, asking adults, examining books and pictures, comparing, grouping, and presenting results in the form of drawings, models, or stories.

A project is generally organized in three stages: preparatory (selecting a topic and collecting questions), main (exploration, observation, and experimentation), and final (generalizing results and presenting them).

Project activities are particularly useful for developing an understanding of cause-and-effect relationships and planning skills, that is, higher-level functions of thinking. They also develop children's ability to work collaboratively and communicate their ideas to others.

3.4. Elements of TRIZ

Elements of the TRIZ methodology, originally developed by G. S. Altshuller for the field of engineering and adapted for preschool education [6], such as "Good-Bad," "Find the Contradiction," "What Would Happen If...?", and the "Little People" method, develop children's ability to search for alternative options, analyze contradictory situations, and find creative and non-trivial solutions.

For example, in the "Good-Bad" game, the child identifies both useful and harmful aspects of an object or phenomenon, such as rain. This helps children move beyond one-sided thinking and develop dialectical and multifaceted thinking.

This method is particularly effective in developing elements of creative and critical thinking among older preschool children because it encourages them to move beyond standard and stereotypical answers.

3.5. Construction and Modeling Activities

Working with construction materials such as blocks, LEGO-type sets, natural and building materials, and magnetic constructors develops children's spatial imagination, understanding of whole-part relationships, and planning skills.

Construction activities can conditionally be divided into three types:

Construction according to a model - the child reproduces a ready-made model.

Construction according to conditions - the child creates a structure according to specified conditions, for example, "make the house tall and wide."

Free or creative construction - the child implements their own idea.

Each type develops different aspects of thinking: imitation and analysis, planning while taking conditions into account, and creative imagination, respectively.

Modeling, such as constructing according to a scheme or drawing and finding a route according to a map, serves as a bridge from visual-figurative thinking to a schematic-symbolic level. This is an important indicator of school readiness.

3.6. Logical-Mathematical Games and Dienes and Cuisenaire Materials

Working with logical blocks (Dienes blocks) and colored rods (Cuisenaire rods) develops children's initial skills in classification, coding, and algorithmic thinking.

Using Dienes blocks, children learn to classify objects according to several characteristics simultaneously, such as color, shape, size, and thickness. This stimulates the process of considering several parameters at the same time, thereby contributing to the development of more complex thinking.

Cuisenaire rods allow children to experience concepts of number and quantity, as well as whole-part relationships, in a visual and concrete manner. These tools prepare children to move from concrete objects to abstract characteristics, thereby creating a foundation for later learning mathematics at school.

3.7. Working with Fairy Tales and Texts

Working with fairy tales and stories-including listening to them, discussing their content, evaluating characters' behavior, continuing the story, or changing its ending-develops children's ability to understand causal relationships, reconstruct the sequence of events, and make predictions.

Questions such as "What if the fairy tale had ended differently?" encourage children to imagine alternative scenarios and thereby support the early development of hypothetical-deductive thinking.

4. The Role of the Educator and Family in Developing Thinking

The effectiveness of educational technologies largely depends on the position of the adults who implement them.

The educator should not simply provide ready-made knowledge but should act as a "partner" who organizes children's exploratory activities, asks questions, and provides support.

The following pedagogical positions are particularly important: treating children's mistakes not critically but as a natural part of the exploration process; giving children sufficient time to think rather than demanding immediate answers; and using open-ended questions such as "Why do you think this happened?" instead of closed questions requiring only "yes" or "no" answers.

The family also plays an important role in the development of thinking. Everyday activities at home-such as preparing food together in the kitchen, shopping, and observing the environment during walks-naturally provide opportunities to compare, count, and discuss cause-and-effect relationships.

Consistency between kindergarten and family, including maintaining similar approaches and expectations, helps ensure stability in the child's cognitive development.

5. The Influence of the Digital Environment on Thinking Development: Opportunities and Risks

Modern digital tools, including educational applications and interactive games, can contribute to the development of children's attention, visual perception, and certain logical skills when used appropriately and in moderation.

However, excessive passive screen time may limit opportunities for developing thinking through practical, object-based activities and live communication. Several studies have also noted that excessive screen exposure may contribute to instability of attention and a reduction in the depth of imaginative activity.

Therefore, specialists recommend that the use of screen-based technologies in preschool education be organized in accordance with age-appropriate limits, under adult supervision and through joint discussion, and in a way that does not completely replace live activities.

6. Methods for Diagnosing Thinking Development

For practicing educators and psychologists, periodically assessing the level of children's thinking development is important because it makes it possible to individualize educational technologies.

The following types of diagnostic tasks are widely used in preschool education:

"Find the Odd One Out" tasks - for assessing the level of generalization and classification;

Seriation tasks - for arranging objects according to size or another characteristic;

"Assemble the Whole from Parts" tasks - for assessing analytical and synthetic abilities;

Reconstructing a sequence of cause-and-effect pictures - for assessing the child's understanding of the logic of events.

Such simple, game-based tasks make it possible to observe the dynamics of thinking development without causing stress to the child and allow educators to provide individual assistance when necessary.

It is important to emphasize that diagnostic results should not be used to "evaluate" an individual child but rather to adapt the educational process to the child's needs. This is an important pedagogical and ethical requirement.

7. Problems and Ways to Overcome Them

In practice, several problems may arise when implementing technologies aimed at developing thinking:

Some educators may be reluctant to abandon the habit of providing ready-made "correct answers";

The large number of children in groups may make it difficult to provide an individualized approach;

Methodological and didactic materials may be insufficient;

Some parents may focus primarily on teaching "letters and numbers" and underestimate the importance of activities aimed at developing thinking.

To overcome these problems, it is necessary to provide educators with continuous professional development, methodological manuals and game materials, and conduct explanatory and educational work with parents.

Conclusion. Developing thinking processes in preschool-aged children requires a holistic, consistent, and age-appropriate pedagogical system.

An educational process organized on the basis of the theoretical foundations of Vygotsky, Piaget, and Elkonin, together with the neuropsychological foundations proposed by Luria, ensures a gradual transition from visual-active thinking to visual-figurative thinking and subsequently to the early forms of logical thinking.

Methods such as problem-based learning, systems of didactic games, project-based technology, elements of TRIZ, construction and modeling activities, and logical-mathematical tools produce the greatest effect when they complement one another and are applied according to children's age characteristics.

In this process, cooperation between educators and families, conscious and moderate use of digital tools, and regular diagnosis of thinking development are essential conditions.

Future research should empirically examine the effectiveness of these technologies in practice-for example, by comparing control and experimental groups using standardized methods for measuring thinking operations. It is also advisable to investigate the adaptation of these technologies for children living in different sociocultural conditions.

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