

METACOGNITION IN PRESCHOOL AGE: OPPORTUNITIES AND LIMITATIONS OF FORMATION

Karimova Guzalkhon Berdikul kizi

guzalasamsutdinova1803@gmail.com

Doctoral Student, Namangan State Pedagogical Institute

Phone: +998 97 413 18 03

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Abstract. Metacognition, understood as the ability to be aware, control and regulate one's own cognitive processes, plays a key role in the formation of independent learning and self-regulation. At preschool age (from 3 to 7 years), the formation of metacognitive functions is a complex, heterochronic process due to both biological maturation and socio-cultural factors. This work is devoted to the analysis of the possibilities and limitations of the development of metacognition in preschool children from the standpoint of cultural-historical psychology and modern empirical research.

The purpose of the study is to identify sensitive periods of metacognitive development, to determine the pedagogical conditions that contribute to its formation, and to identify the factors limiting this process. The paper considers the theoretical foundations of the concept of metacognition (J. Flavell, A. Brown, etc.), analyzes the features of its manifestation in preschool age, including the role of dialectical thinking and figurative means. Particular attention is paid to the possibilities of specially organized learning through metacognitive conversations, project activities, games and visual models, as well as to the limitations associated with the immaturity of reflection, the features of executive functions and methodological difficulties in diagnosis.

Based on the generalization of domestic (T.E. Chernokov et al.) and foreign data, it is shown that the age of 5–6 years is sensitive for the development of metacognitive knowledge and strategies, but full-fledged reflexive regulation requires a transition to the school period. Formative experiments confirm the effectiveness of dialectical means for transforming cognitive strategies and stimulating intellectual development. Practical recommendations are aimed at teachers of preschool educational organizations and include the integration of metacognitive technologies into everyday activities. The results of the study emphasize the need to take into account the individual and age characteristics of children for the successful development of metacognition as the basis for school readiness and lifelong learning.

Keywords: metacognition, metacognition, preschool age, self-regulation of cognitive activity, cultural-historical approach, dialectical thinking, metacognitive strategies, possibilities and limitations of formation, pedagogical conditions.

Annotatsiya. Metakognitsiya –shaxsning o‘z kognitiv jarayonlarini anglash, nazorat qilish va boshqarish qobiliyati sifatida mustaqil ta’lim olish hamda o‘z-o‘zini boshqarish ko‘nikmalarining shakllanishida muhim o‘rin tutadi. Maktabgacha yosh davrida (3 yoshdan 7 yoshgacha) metakognitiv funksiyalarning shakllanishi biologik yetilish hamda ijtimoiy-madaniy omillar ta’siri bilan bog‘liq murakkab va geteroxron jarayon hisoblanadi. Mazkur ish madaniy-tarixiy psixologiya hamda zamonaviy empirik tadqiqotlar nuqtayi nazaridan maktabgacha yoshdagi bolalarda metakognitsiyani rivojlantirish imkoniyatlari va cheklovlarini tahlil qilishga bag‘ishlangan.

Tadqiqotning maqsadi – metakognitiv rivojlanishning senzitiv davrlarini aniqlash, uning shakllanishiga yordam beruvchi pedagogik shart-sharoitlarni belgilash hamda mazkur jarayonni cheklovchi omillarni aniqlashdan iborat. Ishda metakognitsiya tushunchasining nazariy asoslari (J. Flavell, A. Brown va boshqalar) ko‘rib chiqilib, uning maktabgacha yosh davrida namoyon bo‘lish xususiyatlari, jumladan, dialektik tafakkur va obrazli vositalarning roli tahlil qilingan. Metakognitiv suhbatlar, loyiha faoliyati, o‘yinlar va vizual modellar orqali maxsus tashkil etilgan ta’limning imkoniyatlariga, shuningdek, refleksiyaning yetarlicha shakllanmaganligi, ijro funksiyalarining rivojlanish xususiyatlari hamda diagnostikadagi metodik qiyinchiliklar bilan bog‘liq cheklovlarga alohida e’tibor qaratilgan.

Mahalliy (T.E. Chernokova va boshqalar) hamda xorijiy tadqiqotlar natijalarini umumlashtirish asosida 5–6 yosh davri metakognitiv bilim va strategiyalarni rivojlantirish uchun senzitiv davr ekanligi, biroq to‘laonli refleksiv boshqaruvning shakllanishi maktab ta’limi bosqichiga o‘tishni talab qilishi ko‘rsatib berilgan. Shakllantiruvchi tajribalar kognitiv strategiyalarni o‘zgartirish va intellektual rivojlanishni rag‘batlantirishda dialektik vositalarning samaradorligini tasdiqlaydi. Amaliy tavsiyalar maktabgacha ta’lim tashkilotlari pedagoglariga mo‘ljallangan bo‘lib, metakognitiv texnologiyalarni bolalarning kundalik faoliyatiga integratsiya qilishni nazarda tutadi. Tadqiqot natijalari metakognitsiyani maktab ta’limiga tayyorgarlik va uzluksiz ta’limning muhim asosi sifatida muvaffaqiyatli rivojlantirishda bolalarning individual va yosh xususiyatlarini hisobga olish zarurligini ta’kidlaydi.

Kalit so‘zlar: metakognitsiya, maktabgacha yosh, kognitiv faoliyatni o‘z-o‘zini boshqarish, madaniy-tarixiy yondashuv, dialektik tafakkur, metakognitiv strategiyalar, shakllantirish imkoniyatlari va cheklovlari, pedagogik shart-sharoitlar.

Аннотация. Метакогниция, понимаемая как способность осознавать, контролировать и регулировать собственные когнитивные процессы, играет ключевую роль в формировании самостоятельного обучения и саморегуляции. В дошкольном возрасте (от 3 до 7 лет) становление метакогнитивных функций представляет собой сложный, гетерохронный процесс, обусловленный как биологическим созреванием, так и социокультурными факторами. Настоящая работа посвящена анализу возможностей и ограничений развития метакогниции у детей дошкольного возраста с позиций культурно-исторической психологии и современных эмпирических исследований.

Цель исследования — выявить сензитивные периоды метакогнитивного развития, определить педагогические условия, способствующие его формированию, а также выявить факторы, ограничивающие данный процесс. В работе рассматриваются теоретические основы концепции метакогниции (Дж. Флавелл, А. Браун и др.), анализируются особенности её проявления в дошкольном возрасте, в том числе роль диалектического мышления и образных средств. Особое внимание уделяется возможностям специально организованного обучения посредством метакогнитивных бесед, проектной деятельности, игр и визуальных моделей, а также ограничениям, связанным с недостаточной зрелостью рефлексии, особенностями исполнительных функций и методическими трудностями диагностики.

На основе обобщения отечественных (Т.Е. Чернокова и др.) и зарубежных исследований показано, что возраст 5–6 лет является сензитивным периодом для развития метакогнитивных знаний и стратегий, однако полноценная рефлексивная регуляция требует перехода к периоду школьного обучения. Формирующие эксперименты подтверждают эффективность диалектических средств в преобразовании когнитивных

стратегий и стимулировании интеллектуального развития. Практические рекомендации адресованы педагогам дошкольных образовательных организаций и предусматривают интеграцию метакогнитивных технологий в повседневную деятельность детей. Результаты исследования подчеркивают необходимость учета индивидуальных и возрастных особенностей детей для успешного развития метакогнитивности как основы готовности к школьному обучению и непрерывному образованию на протяжении всей жизни.

Ключевые слова: метакогнитивность, дошкольный возраст, саморегуляция когнитивной деятельности, культурно-исторический подход, диалектическое мышление, метакогнитивные стратегии, возможности и ограничения формирования, педагогические условия.

Modern preschool education in Uzbekistan and the CIS countries is focused on the development of universal educational activities, among which metacognition – "thinking about thinking" – occupies a central place [1]. The state educational standard of preschool education emphasizes the need to form children's skills of goal-setting, planning, control and evaluation of their own activities, which is directly related to metacognitive processes. The relevance of the topic is due to the growing requirements for the independence of students in the context of digitalization and the uncertainty of the future, where self-learning and self-regulation are becoming key competencies.

The concept of metacognition was introduced by J. Flavell in 1979 and since then has been actively studied in cognitive psychology, educational psychology and neuroscience. In pedagogical science, the problem of metacognition is developed in line with the cultural-historical theory of L.S. Vygotsky, where the emphasis is placed on the role of cultural means and the social situation of development [2]. Despite a significant number of studies, the question of the possibilities and limitations of the formation of metacognition in preschool age remains debatable. Foreign authors have traditionally attributed full-fledged metacognition to primary school age (7–8 years), explaining this by the immaturity of reflection and executive functions. However, modern data obtained with the help of sensitive techniques (observation, metacognitive conversations) indicate the presence of the rudiments of metacognition in children as early as 3–4 years old [3].

The purpose of this work is a comprehensive analysis of the possibilities and limitations of the formation of metacognition in preschool age. To achieve the goal, the following tasks are solved: 1) to reveal the theoretical foundations of metacognition; 2) to characterize the age features of its development; 3) to identify the pedagogical possibilities of formation; 4) to identify the main limitations; 5) formulate practical recommendations. The methodological basis is the cultural-historical approach, supplemented by structural-dialectical analysis (N.E. Veraksa, T.E. Chernokova). The empirical base includes a generalization of the results of domestic and foreign studies in 2024–2025.

The scientific novelty of the work lies in the systematization of data on sensitive periods of metacognitive development and the substantiation of the effectiveness of dialectical means in preschool education. The practical significance lies in the development of recommendations for teachers on the integration of metacognitive technologies into the educational process of kindergarten.

1. Theoretical foundations of the concept of "metacognition"

Metacognition is defined as a set of knowledge and processes aimed at regulating one's own cognitive activity. The classical model of J. Flavell's knowledge includes metacognitive knowledge (about oneself as a cognitive subject, about tasks and strategies) and metacognitive experiences (a sense of difficulty, confidence), as well as monitoring and control processes [1]. A. Brown supplemented the model by highlighting executive (planning, monitoring, evaluation) and regulatory components.

In psychology, metacognition is correlated with the concepts of self-regulation (O.A. Konopkin), reflection (V.V. Davydov) and metacognition as the highest mental function. According to L.S. Vygotsky, higher mental functions arise in the process of internalization of cultural means: from external regulation through adult speech to internal self-regulation [2]. Metacognitive processes in this context are the result of mastering sign means (speech, visual models, schemes) that allow the child to move from spontaneous to voluntary behavior.

T.E. Chernokova, developing the ideas of cultural-historical psychology, emphasizes that metacognition in preschool age does not require full reflection, but can be carried out through figurative forms of cognition and dialectical actions (transformation, unification, seriation, change of alternatives) [4]. This allows us to talk about "pre-reflexive" metacognition, where regulation occurs due to egocentric speech, game planning, and visual modeling.

The structure of metacognition includes four main components: gnostic goal-setting, modeling of activity conditions, action programming, and meaningful self-control. These components develop heterochronically, which is confirmed by empirical data. It is important to note the relationship between metacognition and executive functions (inhibition, working memory, cognitive flexibility) and the theory of mind, which lay the foundation for understanding one's own and others' mental states.

Thus, the theoretical foundations allow us to consider metacognition not as a static property, but as a dynamic system formed in the process of interaction of the child with the socio-cultural environment.

Features of the development of metacognition in preschool age

Sensitive periods of metacognition development in preschool age

The concept of sensitive periods of development, introduced into psychology by L.S. Vygotsky and developed in the works of M. Montessori and modern researchers, denotes the time periods of ontogenesis when the child's body or psyche shows increased susceptibility to certain environmental influences, which creates optimal conditions for the formation of certain functions. In the context of metacognition, sensitive periods are characterized not only by the biological maturation of nervous structures (the prefrontal cortex, which is responsible for executive functions), but also by sociocultural opportunities for the internalization of sign means of activity regulation. Preschool age is generally recognized as sensitive for the formation of metacognitive processes, but within it there are substages with different intensity of development [1; 4].

According to the empirical data of T.E. Chernokova, obtained during the examination of 80 children aged 4–7 years, preschool age is a sensitive period of metacognitive development, with a peak of 5–6 years. At this age, children most successfully master metacognitive knowledge (ideas about their own cognitive processes, strategies and conditions for their application) and begin to demonstrate elements of metacognitive processes - planning, monitoring and evaluation of their own activities. The study showed a statistically significant increase in metacognition indicators at the turn of middle and senior preschool age: if at the age

of 4 fragmentary, situational manifestations of self-regulation prevail (mainly in play activity and with the direct support of an adult), then by the age of 5-6 children are already capable of a more stable use of dialectical strategies (transformation, unification of opposites, seriation of alternatives), which allows them to model the conditions of cognitive tasks and correct actions in the process of solving [5; 7].

The younger preschool age (3-4 years) can be considered as a preparatory sensitive substage. At this time, the basic prerequisites for metacognition are laid: children demonstrate the rudiments of monitoring errors in simple tasks (for example, in a constructive game or puzzle tasks), use egocentric speech for self-regulation (according to L.S. Vygotsky) and show rudimentary metacognitive behaviors in the form of spontaneous comments such as "I know" or "it doesn't work". Foreign studies using observational methods (Whitebread et al., 2009; Escolano-Pérez et al., 2019) confirm that children are already capable of elementary metacognitive monitoring at the age of 3 – they persist longer in the right strategies and correct behavior after mistakes, although the verbalization of these processes is still extremely limited. The neurophysiological basis is the active maturation of basic executive functions (inhibition and working memory), but full reflection is impossible due to the immaturity of the prefrontal cortex and the lack of sufficient experience in the internalization of cultural means [36; 15].

The middle preschool age (4-5 years) is marked by a transitional character: here the role of dialectical thinking as a mechanism of metacognition increases. Children begin to take into account alternative solutions, see contradictions in an object or task, and use visual models for planning. According to the dissertation research of T.E. Chernokova, it is the younger and middle preschool age that is sensitive for the development of dialectical thinking and metacognitive strategies in general, since during this period the child is most open to the transformation of spontaneous cognitive actions into voluntary ones [42]. Formative experiments have shown that specially organized problem-contradictory situations (for example, tasks to "transform" an object or a change of perspective) lead to a significant increase in metacognitive skills in this age range.

The peak of sensitivity falls on 5-6 years. During this period, a qualitative leap is observed: children master metacognitive knowledge about themselves as a subject of cognition ("I remember better when I repeat", "it is difficult for me when there are many details"), begin to differentiate cognitive processes (memory vs. attention) and demonstrate elements of meaningful self-control. Chernokova emphasizes that the age of 5–6 years is the most significant for the acquisition of metacognitive knowledge, although there may be no direct impact on the processes of self-regulation without additional pedagogical support [44]. This is due to the fact that metacognition here is still predominantly figurative and contextually related (in a game, project activity), and not completely reflective. Foreign meta-analyses confirm that the period of 3–6 years is a time of rapid progress in metacognitive skills, but the accuracy of calibration (correspondence between subjective assessment and real effectiveness) remains low up to 7–8 years due to overconfidence bias [38; 20].

Senior preschool age (6–7 years old) completes the sensitive period: metacognition approaches the level necessary for schooling, but full-fledged theoretical reflection requires a transition to the next age stage. Here the limitations become more noticeable – the child can plan and control activities, but often needs external support (scaffolding) to transfer strategies to new contexts.

The factors that determine the sensitivity of the period are multi-level. Biological: maturation of neural networks of executive functions (according to neuroimaging, significant

progress at the age of 4-6). Socio-cultural: the leading role of the role-playing game as a "natural laboratory" of metacognition, where the child models, plans and evaluates actions in the zone of proximal development. Pedagogical: the effectiveness of metacognitive conversations, project activities and dialectical tasks at the age of 5–6 years has been proven by formative experiments [6; 24].

Thus, sensitive periods of metacognition in preschool age are not rigidly fixed "windows", but are dynamic phases of increased plasticity, where cultural and historical means (speech, models, dialectical actions) meet the readiness of the child's psyche. Skipping or ignoring these periods can lead to delayed difficulties in self-regulation of learning, which emphasizes the need for purposeful pedagogical work at the age of 4-6. Further research should take into account individual trajectories (the impact of bilingualism, socioeconomic status) and the capabilities of digital tools to support metacognitive development in sensitive phases.

Preschool age as a whole is characterized by intensive development of the cognitive sphere, but metacognitive abilities are manifested unevenly. According to T.E. Chernokova, the most sensitive period is the age of 5–6 years: it is at this time that children form dialectical ideas about cognitive activity as a dynamic system that includes mutually exclusive characteristics [5]. Children begin to set tasks for cognition of the properties of the object, its connections and possible directions of development, taking into account external and internal factors.

Empirical studies show that children of 3-4 years of age demonstrate the rudiments of metacognition: they can plan simple actions in a game, adjust strategies in case of failure, and use egocentric speech for self-regulation. However, these manifestations are fragmentary and depend on the support of an adult. By the age of 5-7, a qualitative leap is observed: children master the elements of meaningful self-control, draw up long-term action programs with solution options and differentiate cognitive processes (perception, memory, thinking).

Foreign studies confirm the early emergence of metacognition. Using observational methods (Whitebread et al., 2009), it was revealed that children already at the age of 3 show metacognitive talk and reflective behaviors in the process of play and exploration. However, the accuracy of monitoring (calibration) remains low: preschoolers often overestimate their abilities (overconfidence bias), which is explained by the immaturity of the prefrontal cortex.

Age-related features are associated with the transition from visual-figurative thinking (according to Piaget, the preoperational stage) to the elements of logical thinking. The game as the leading activity of a preschooler creates optimal conditions for the development of metacognition: in a role-playing game, the child models conditions, plans and controls actions, mastering cultural means.

Possibilities for the formation of metacognition in preschoolers

The possibilities for the formation of metacognition in preschool age are significant under the condition of specially organized training. The cultural-historical approach involves the use of cultural means that correspond to the age capabilities of the child. T.E. Chernokova has developed a method based on dialectical thinking: through problem-contradictory situations and open tasks, children learn to transform solution strategies (metacognitive strategies) [6]. Formative experiments showed positive dynamics: the experimental group demonstrated a significant improvement in the use of dialectical actions, which correlated with an increase in general intelligence on the Wechsler scale.

Effective technologies are:

1. Metacognitive conversations ("What were you thinking when you decided?", "What can you do differently?").
2. Project activity, where the child plans, implements and evaluates the result.
3. Visual models and schemes (according to L.A. Wenger) for the indicative basis of actions.
4. Games with rules aimed at developing inhibition and flexibility.

Foreign meta-analyses (Eberhart et al., 2025) confirm the effectiveness of interventions: the effect of size $g=0.48$ for self-regulated learning and academic achievement. Programs that are integrated into the daily activities of teachers, rather than conducted by external researchers, are especially successful [3].

Thus, the possibilities are realized through the zone of proximal development: the adult acts as a scaffold, gradually transferring regulation to the child.

Limitations of metacognition formation in preschool age

Despite the potential, there are significant limitations. First, cognitive: the lack of full reflection and theoretical thinking (according to Vygotsky – before school age). Metacognition of preschoolers is mainly figurative and unconscious, which limits the depth of regulation.

Second, neurophysiological: immaturity of executive functions and the prefrontal cortex leads to difficulties in working memory and inhibition. Children often show perseveration.

Thirdly, methodological: diagnosis is difficult due to the limitations of verbalization and dependence on motivation. Traditional tests (metacognitive conversation) require high linguistic competence.

Fourthly, socio-cultural and individual: low level of metacognitive knowledge among parents and teachers, lack of systematic work in preschool education, gender and socio-economic differences. Some children with high intelligence demonstrate poor self-regulation due to a lack of experience in overcoming difficulties.

Finally, environmental factors: an overabundance of digital stimuli can reduce the depth of reflection, and stress can disrupt motivation for self-control.

Metacognition in preschool age is a dynamic system with significant opportunities for formation, provided that age characteristics are taken into account and adequate cultural means are used. The age of 5-6 years is a sensitive period, when dialectical and figurative means make it possible to lay the foundation for self-regulation. However, the limitations associated with the immaturity of reflection and executive functions require a cautious, scaffolding approach.

Practical recommendations for educators include: regular use of metacognitive language in everyday interactions; introduction of games and projects aimed at dialectical thinking; training parents in the basics of metacognitive support; monitoring of the individual dynamics of each child.

Prospects for further research are related to the development of digital tools for metacognitive learning, the study of the impact of bilingualism and cross-cultural features. The formation of metacognition in preschool age is an investment in the future, contributing to the formation of a competent, independent personality in the modern world.

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