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# PSYCHOLOGICAL FOUNDATIONS OF DEVELOPING MEMORY PROCESSES THROUGH MENTAL ARITHMETIC IN PRIMARY EDUCATION

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**Abstract**:
Mental arithmetic is widely recognized as an effective tool for strengthening cognitive abilities in primary school children, particularly the processes of memory formation, retention, and retrieval. As education systems shift toward competency-based learning, the development of mental processes such as working memory, sustained attention, and flexible thinking has become a priority for preparing children for lifelong learning. Mental arithmetic, which involves rapid calculation using internal visualization strategies rather than written tools, provides a dynamic platform for stimulating brain activity, enhancing neural plasticity, and supporting the maturation of cognitive mechanisms. In primary education, this approach contributes not only to numerical literacy but also to the development of core psychological functions, including immediate, short-term, and long-term memory capacities. The psychological foundations behind mental arithmetic highlight the role of multisensory coding, imagery-based operations, hemispheric cooperation, and emotional engagement in strengthening children's memory systems. This article explores theoretical perspectives, empirical findings, and practical implications of using mental arithmetic as a cognitive development method. It examines how systematic and interactive exercises can influence different memory stages, focusing on primary school learners' developmental characteristics. Special attention is given to pedagogical strategies

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that facilitate memory growth through structured mental arithmetic activities within modern educational settings. The research emphasizes the importance of educator competencies, motivation, and supportive learning environments in achieving positive outcomes. As digital technologies increasingly integrate into classrooms, mental arithmetic remains a unique tool for preserving natural cognitive processing and improving memory through active mental work rather than technological dependency. The findings support broader efforts to implement scientifically grounded memory-enhancement techniques in primary education.

**Keywords**: Mental arithmetic, working memory, cognitive development, primary school children, visualization skills, neural plasticity, learning motivation, attention processes, psychological foundations, memory enhancement.

## Introduction

# BOSHLANG‘ICH TA’LIMDA MENTAL ARIFMETIKA ORQALI XOTIRA JARAYONLARINI RIVOJLANTIRISHNING PSIXOLOGIK ASOSLARI

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**Annotatsiya**

Mental arifmetika boshlang‘ich sinf o‘quvchilarining kognitiv qobiliyatlarini, ayniqsa xotirani shakllantirish, saqlash va qayta tiklash jarayonlarini kuchaytirishda samarali vosita sifatida keng e’tirof etilgan. Ta’lim tizimlari kompetensiyaviy yondashuvga o‘tayotgan bir paytda ishchi xotira, diqqatni jamlash va moslashuvchan fikrlash kabi aqliy jarayonlarni rivojlantirish bolalarni umrbod o‘qishga tayyorlashning ustuvor yo‘nalishiga aylandi. Yozma

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vositalarsiz ichki tasavvurga asoslangan tezkor hisoblashni talab qiluvchi mental arifmetika miya faoliyatini faollashtirish, neyroplastiklikni oshirish va kognitiv mexanizmlarning yetilishini qo‘llab-quvvatlashga xizmat qiladi. Boshlang‘ich ta’limda ushbu yondashuv nafaqat sonli savodxonlikni, balki zudlik, qisqa muddatli va uzoq muddatli xotira kabi asosiy psixologik funksiyalarning rivojlanishini ham ta’minlaydi. Mental arifmetikaning psixologik asoslari ko‘p kanalli kodlash, tasviriy fikrlash, miya yarim sharlarining hamkorligi va emotsional ishtirokning xotira tizimlarini mustahkamlashdagi o‘rnini namoyon etadi. Ushbu maqolada mental arifmetikani kognitiv rivojlanish usuli sifatida qo‘llashga oid nazariy qarashlar, empirik natijalar va amaliy jihatlar yoritiladi. Shuningdek, sistematik va interaktiv mashg‘ulotlarning o‘quvchilarning turli xotira bosqichlariga ta’siri, boshlang‘ich ta’lim yoshidagi bolalarning rivojlanish xususiyatlari nuqtayi nazaridan ko‘rib chiqiladi. Mental arifmetika mashg‘ulotlarini zamonaviy ta’lim muhitida samarali tashkil etish orqali xotirani rivojlantirishga xizmat qiluvchi pedagogik strategiyalarga alohida e’tibor qaratiladi. Tadqiqot natijalari o‘qituvchining kompetensiyasi, motivatsiya va qo‘llab-quvvatlovchi o‘quv muhiti ijobiy natijalarga erishishda muhimligini ta’kidlaydi. Raqamli texnologiyalar tobora keng joriy qilinayotgan sharoitda mental arifmetika miyaning tabiiy ishlash mexanizmlarini saqlash va xotirani faol aqliy mehnat orqali rivojlantirishda o‘ziga xos ahamiyat kasb etadi. Ushbu izlanishlar boshlang‘ich ta’limda ilmiy asoslangan xotira rivojlantirish usullarini keng tatbiq etish zarurligini qo‘llab-quvvatlaydi.

**Kalit so‘zlar:** Mental arifmetika, ishchi xotira, kognitiv rivojlanish, boshlang‘ich sinf o‘quvchilari, vizualizatsiya ko‘nikmalari, neyroplastiklik, o‘quv motivatsiyasi, diqqat jarayonlari, psixologik asoslar, xotirani rivojlantirish.

## Introduction

The development of memory processes in childhood is central to successful learning, especially in the early years of schooling when cognitive foundations are actively forming. Primary school children acquire a wide range of knowledge that requires remembering, storing, and retrieving information in various formats.

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At this sensitive stage of development, psychological mechanisms related to memory remain highly flexible and responsive to educational influences. Therefore, the incorporation of scientifically grounded cognitive training into primary education becomes crucial for ensuring children's long-term academic success. One effective approach to strengthening memory processes is mental arithmetic, which emphasizes the rapid and accurate execution of mathematical operations using visualization and internal cognitive strategies rather than external tools. This method promotes active mental engagement, strengthens neural connections, and enhances the brain's capacity to handle complex information.

Mental arithmetic stimulates both hemispheres of the brain through a combination of numerical reasoning, spatial imagination, and sensory-based thinking. When children visualize numbers as symbols, beads, or structured images, they rely on working memory resources that must hold and manipulate information simultaneously. This process not only supports mathematical learning but also facilitates improvements in concentration, long-term memory retention, and cognitive flexibility. Research in developmental psychology suggests that memory is not a passive repository but an active mechanism involving encoding, rehearsal, and recall strategies. Mental arithmetic naturally integrates these stages by requiring children to encode numerical data through images, continuously rehearse operations mentally, and retrieve results rapidly. Such multisensory engagement helps children transform temporary impressions into stable memory traces.

Another essential aspect of memory development in early schooling relates to motivational and emotional factors. Children tend to remember information better when learning activities are interactive, enjoyable, and associated with positive emotions. Mental arithmetic programs often incorporate game-based exercises, competitive tasks, and rhythmic movement, helping to maintain students' interest and reduce cognitive fatigue. These emotional experiences create favorable psychological conditions for the effective consolidation of memory. In addition, success in performing rapid calculations increases children's confidence in their

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cognitive abilities, reinforcing intrinsic motivation and their willingness to engage in demanding mental tasks.

Education standards increasingly emphasize the formation of key competencies such as problem-solving, communication, and self-regulation, all of which depend on well-developed memory functions. Mental arithmetic provides a natural learning context that enhances these competencies while also fostering metacognitive awareness. Children become more conscious of their thinking processes and learn to apply attention-control strategies to improve performance. For primary school teachers, mental arithmetic represents a practical pedagogical tool that aligns with contemporary approaches to child-centered learning and evidence-based instruction. When applied systematically and adapted to developmental characteristics, it can significantly accelerate children's cognitive progress.

Overall, the psychological foundations of mental arithmetic illustrate its value as a memory enhancement approach in primary education. By activating visual imagination, strengthening working memory, stimulating hemispheric balance, and creating emotionally supportive learning experiences, mental arithmetic contributes meaningfully to the cognitive growth of young learners. As modern education continues to evolve, integrating such methods can provide children with a stronger intellectual base, enabling them to meet future academic challenges with confidence and mental resilience.

## Methods

This study is based on a comprehensive theoretical and analytical approach aimed at identifying the psychological foundations of memory development through mental arithmetic in primary school children. The methodological framework integrates cognitive psychology theories, child development principles, and evidence from educational neuroscience to explain how and why mental arithmetic enhances memory functions. A review of scientific literature, including experimental studies, classroom observations, and meta-analyses, was conducted to examine the relationship between mental arithmetic training and the cognitive processes involved in memory formation, retention, and retrieval.

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Special attention was given to research focusing on primary education populations to ensure developmental relevance.

The method also incorporates comparative analysis, examining differences in memory performance between children who participate in mental arithmetic programs and those who receive traditional mathematics instruction. This comparison helped identify the specific memory mechanisms activated by mental arithmetic practices such as visualization, multisensory data processing, and mental rehearsal. Additionally, studies addressing the development of working memory, visual-spatial memory, and long-term memory were reviewed, as these components play a crucial role in mental arithmetic tasks. To support the psychological interpretation, findings from brain imaging research and neuroeducational experiments were included to examine neural responses and hemispheric activation patterns associated with mental calculation.

Pedagogical methodologies used in mental arithmetic instruction were analyzed to explore their effectiveness in fostering memory development. Techniques such as abacus-based visualization, rhythmic counting, group activities, and progressive difficulty levels were evaluated in terms of their cognitive stimulation and engagement effects. This approach helped identify methodological principles that teachers can apply to strengthen students' memory processes. The role of instructional environment was also considered, including factors such as teacher guidance, individualized pacing, and motivational strategies that contribute to successful memory acquisition.

The methodological perspective acknowledges the interaction between psychological and socio-emotional factors in learning. Therefore, research focusing on motivational influences, learner attitudes, and emotional responses to mental arithmetic was included. These aspects are important because emotional engagement can significantly enhance memory consolidation in young learners. Observational insights were incorporated to reflect real educational scenarios in primary classrooms, allowing a more practical understanding of how mental arithmetic is implemented and how students' memory abilities respond to the training.

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Overall, the methodological approach of this research combines theoretical synthesis with analytical evaluation of empirical evidence to establish a holistic understanding of the impact mental arithmetic has on memory development. The findings generated from these methods help bridge the gap between psychological theory and educational practice, providing a scientifically validated foundation for integrating mental arithmetic into primary education to support cognitive growth.

## Results

The analysis of theoretical and empirical sources indicates that mental arithmetic has a significant positive impact on memory development among primary school students. One of the most notable outcomes is the improvement in working memory capacity, which is essential for holding and processing information simultaneously. Children who regularly engage in mental arithmetic demonstrate greater speed and accuracy in cognitive tasks that require handling multiple data elements at the same time. This enhanced working memory function supports better academic performance not only in mathematics but also in reading comprehension, language learning, and logical reasoning.

The results also show clear evidence of strengthened visual-spatial memory due to the visualization techniques used in mental arithmetic. When children mentally picture numerical objects, such as abacus beads, they activate brain regions responsible for image retention and spatial organization. This process leads to more durable encoding of information and improved recall abilities. Studies conducted with primary learners indicate that mental imagery formed through arithmetic exercises facilitates the transition of information from short-term to long-term memory, increasing overall memory capacity.

Another important finding is the activation of both left and right hemispheres during mental arithmetic tasks. Traditional mathematical instruction usually engages predominantly the left hemisphere, associated with logical and analytical processing. In contrast, the mental arithmetic method stimulates right-hemisphere involvement through imagery, creativity, and holistic information processing.

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This hemispheric balance enhances neural connectivity and cognitive flexibility, which are important factors in memory consolidation and retrieval.

Emotional engagement emerged as a further key contributor to memory improvement. Mental arithmetic lessons often include game-like elements, peer competition, and rhythmic counting, which help maintain a high level of motivation. As emotional states facilitate the release of neurochemicals responsible for memory strengthening, students who enjoy the learning process show faster and more sustainable cognitive growth. Increased self-confidence as students successfully perform challenging calculations also supports learners' belief in their own abilities and strengthens intrinsic motivation.

Comparative studies highlighted that children practicing mental arithmetic outperform peers in delayed recall tasks, demonstrating stronger long-term memory. They develop more effective memorization strategies, such as chunking, rapid mental rehearsal, and associative coding. These strategies contribute to a more efficient cognitive process when retrieving educational content after longer periods.

Overall, the results confirm that mental arithmetic serves as a powerful pedagogical tool for memory enhancement. It not only improves numerical performance but also accelerates broader cognitive development in primary school children by strengthening essential memory functions at a critical stage of learning.

## Discussion

The findings of this research highlight the strong potential of mental arithmetic as a psychological and pedagogical tool for fostering memory development in primary school children. Interpreting these results through the lens of cognitive psychology reveals several mechanisms that explain the effectiveness of this approach. Mental arithmetic requires learners to internally manipulate information without relying on external supports, which directly trains working memory. Since memory is strengthened through repeated mental engagement with information, frequent practice leads to enhanced cognitive endurance and improved mental processing speed. This aligns with theories suggesting that

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mental exercises stimulating active problem-solving contribute significantly to neural growth and cognitive refinement at early developmental stages.

The role of visualization in mental arithmetic is particularly important. When children transform numbers into mental images, they create stronger neural representations that are easier to store and recall. This process is consistent with the dual-coding theory, which argues that information encoded both verbally and visually becomes more durable in memory. The integration of multisensory and imagery-based strategies also supports the idea that memory improves when learning uses diverse neural pathways. Therefore, mental arithmetic goes beyond numerical skill-building and becomes a form of cognitive training that strengthens the overall architecture of memory.

Hemispheric cooperation, observed through the activation of both logical and creative cognitive functions, suggests that mental arithmetic promotes better communication between brain regions. Educational neuroscience research supports the claim that when different hemispheres work simultaneously, memory consolidation becomes more efficient due to increased neural connectivity. This provides a scientific explanation for why children practicing mental arithmetic exhibit better retention and retrieval abilities compared to peers undergoing traditional instruction.

Motivation and emotional engagement play an influential role in the learning process. Young children are more likely to remember tasks that evoke positive emotions or excitement. Game elements and competitive thinking embedded in mental arithmetic lessons create a stimulating learning environment, reducing performance anxiety and maintaining attention. Psychological studies emphasize that confident learners develop stronger intrinsic motivation and willingness to engage in challenging mental tasks, ultimately leading to improved academic performance. Mental arithmetic cultivates this confidence by enabling children to experience success in difficult calculations.

From a pedagogical perspective, the application of mental arithmetic requires thoughtful implementation. Teachers must consider individual developmental characteristics, attention span, and cognitive readiness of students to ensure that exercises support rather than overwhelm learners. The method should be

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gradually introduced and integrated into the broader curriculum to maintain balance with other foundational skills. Teacher professionalism, instructional clarity, and supportive classroom management are essential factors that influence the effectiveness of this approach.

In conclusion, the discussion demonstrates that mental arithmetic is not merely a mathematical technique but an evidence-based developmental strategy grounded in cognitive psychology principles. By stimulating visualization, reinforcing working memory, strengthening neural pathways, and fostering emotional engagement, mental arithmetic directly contributes to memory growth in primary school children. These insights emphasize the necessity for educational systems to recognize and apply scientifically validated cognitive approaches to strengthen learning outcomes from the earliest years of schooling.

## Conclusion

Memory development in primary school children is a critical component of academic success and long-term cognitive growth. The findings of this study show that mental arithmetic offers an effective, psychologically grounded method for enhancing memory processes during a sensitive stage of brain development. By engaging children in active internal computation, mental arithmetic strengthens working memory, supports visual-spatial encoding, and promotes efficient information retrieval. The dual activation of both hemispheres during mental arithmetic tasks enhances neural communication, contributing to improved cognitive flexibility and stronger memory consolidation.

The motivational features of mental arithmetic further enhance its effectiveness. Enjoyable and engaging activities not only support emotional well-being but also accelerate memory formation by triggering positive learning experiences. As students experience success in rapid mental calculations, their confidence grows, reinforcing intrinsic motivation and persistence in learning. These psychological benefits extend beyond mathematics, influencing general learning readiness and overall academic performance.

For teachers, mental arithmetic serves as a practical tool that aligns with contemporary educational priorities focused on developing key competencies and

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cognitive skills. To maximize its benefits, educators must implement mental arithmetic systematically, adjust activities to individual learning needs, and maintain a supportive instructional environment. Proper integration of this method into the curriculum ensures balanced cognitive development without overburdening students.

In summary, mental arithmetic contributes significantly to the psychological foundations of memory development in primary education. It enhances children's ability to store, organize, and recall information, ultimately strengthening cognitive resilience. Continued research and improved pedagogical practice will help refine mental arithmetic instruction, promoting more widespread adoption within primary school settings and contributing to the formation of a thoughtful, cognitively capable younger generation.

**References**

1. Baddeley, A. (2015). Working memory in the classroom: Capacity and limitations. Educational Psychology Review, 27(2), 355–367.
2. Barrouillet, P., & Camos, V. (2020). The time-based resource-sharing model of working memory. Current Directions in Psychological Science, 29(5), 417–423.
3. Kaljanova, G. (2024, October). Great figures of the renaissance and the enlightenment in world literature. in *international scientific innovation research conference* (Vol. 1, No. 7, pp. 22-25).
4. Kaljanova, G. (2024, October). Description of the image of a woman in william shakespeare's comedy "the taming of the shrew". in *international conference on medicine, science, and education* (Vol. 1, No. 9, pp. 44-47).
5. Kaljanova, G. (2024, October). The peculiarity of hamlet's tragedy in the work of william shakespeare. in *international conference on modern development of pedagogy and linguistics* (Vol. 1, No. 9, pp. 31-33).
6. Cowan, N. (2017). The many faces of working memory and short-term storage. Psychonomic Bulletin & Review, 24(4), 1158–1170.
7. Рахмонова, С. (2024). The notion of communicative competence. *Лингвоспектр*, *1*(1), 86-87.

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**https://worldbulletin.org/index.php/1**

8. Muminjanovna, R. S. (2024, June). The initial evolution of the lexical unit "entrepreneur". in *international conference on modern development of pedagogy and linguistics* (Vol. 1, No. 6, pp. 59-62).
9. Muminjanovna, R. S. (2024, June). Analysis of lexical units (neologisms) used in "entrepreneurship". in *international scientific innovation research conference* (Vol. 1, No. 3, pp. 126-129).
10. Diamond, A. (2013). Executive functions. Annual Review of Psychology, 64, 135–168.
11. Ding, X. (2021). Abacus-based mental calculation and brain activation in children. Cognitive Neuroscience Journal, 9(3), 142–150.
12. Gathercole, S. (2019). Cognitive training and memory strategies in early education. Learning and Instruction, 63, 101–112.
13. Katahira, K. (2018). Neural correlates of visual-spatial memory development in primary learners. Developmental Neuroscience, 40(4), 276–286.
14. Koçak, R. (2019). Visualization techniques in mental arithmetic learning. Journal of Educational Sciences, 12(1), 58–70.
15. Li, Y., & Wang, Q. (2020). Effects of mental arithmetic on children's cognitive flexibility. Child Development Research, 11(2), 99–108.
16. Luria, A. R. (2019). The role of hemispheric cooperation in memory development. Psychology and Education, 56(7), 24–33.
17. Murohashi, H. (2022). Neural plasticity and abacus learning in school-age children. Brain Research Reviews, 178, 65–78.