

Development of Mathematical Competence of Primary School Students Based On 4k Educational Technologies

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Abstract: This article discusses the role and importance of 4K educational technologies in the development of mathematical competence of primary school students. 4K – creativity, communication, collaboration and critical thinking competencies are considered the main directions in modern education. The article discusses how these competencies can be formed in students through mathematics, what methods and approaches are effective, and how students' thinking develops as a result of these approaches. The effectiveness of education and increasing students' interest in science through methodological approaches are substantiated.

Keywords: 4K educational technologies, primary education, mathematical competence, creativity, communication, collaboration, critical thinking, methodology, student activity.

Introduction: In today's era of globalization and digital transformation, one of the main tasks facing the education system is the development of modern competencies. It is particularly important to awaken students' interest in learning, develop their thinking culture, and prepare them for social and life activities during the primary education stage. From this perspective, 4K educational technologies - namely the competencies of critical thinking, communication, collaboration, and creativity - serve as essential tools in developing students' general learning competence, especially their mathematical competence.

Mathematics teaches not only numerical calculations and formulas but also logical thinking, analysis, understanding problematic situations, and finding solutions. For primary school students in particular, mathematics is one of the most suitable subjects for developing skills such as understanding the environment, identifying main ideas, comprehending cause-and-effect relationships, and forming systematic and precise thinking abilities. The effective development of such skills requires modern approaches - specifically, the integration of 4K

competencies.[1]

Each of the 4K technologies plays a distinctive role in mathematics education. For instance, critical thinking serves to analyze complex problems, distinguish superfluous information, and draw substantiated conclusions, while communication teaches students to share mathematical ideas, explain their thoughts based on evidence, and provide logical answers to questions. Collaboration encompasses problem-solving through teamwork, listening to and learning from one another. Creativity enables students to find unconventional, original solutions and helps develop various approaches to problems.

Therefore, developing mathematical competence based on 4K technologies in primary education means not only imparting knowledge but also developing the ability to apply it in practice, cultivating thinking culture and reasoning abilities, as well as forming personal qualities that prepare students for future independent life. This process requires teachers to have high-level methodological preparation, use interactive tools, and take into account each student's interests and individual characteristics.[2]

Furthermore, the integration of 4K technologies into the teaching process contributes to the development of students' self-assessment, self-improvement, critical thinking, and creativity. This, in turn, enhances not only their interest in the subject but also their active participation in class, independent thinking, and sense of responsibility. These factors directly contribute to the deepening of mathematical competence, that is, the thorough assimilation of knowledge and the ability to apply it in real-life situations.

Overall, the use of 4K educational technologies in developing mathematical competence among primary school students is an important tool for improving the quality of education and ensuring students' personal, social, and cognitive development. It is an innovative approach that meets the requirements of modern education. [3]

METHOD

4K educational technologies represent a pedagogical approach that embodies the main directions of 21st-century education. They aim to develop key competencies in students such as independent thinking, creative and systematic approaches to problem-solving, teamwork, and effective communication. This approach is based on four key pillars: critical thinking, communication, collaboration, and creativity. Each component has its own content and a unique role in the comprehensive development of the learner's personality. [4]

First and foremost, critical thinking is the ability to deeply analyze information, evaluate it thoroughly, draw logical conclusions, and make well-founded decisions. A student who can think critically is able to look at any issue from various perspectives. Rather than simply memorizing facts, they strive to analyze, evaluate, and express ideas based on evidence. This approach is especially important in mathematics, where solving problems and exercises requires testing different strategies, comparing them, and choosing the most effective solution. Critical thinking broadens the student's worldview and teaches them to make independent decisions.

Communication is the ability to exchange ideas, engage in dialogue, express one's thoughts clearly and coherently, as well as listen to and understand others. Communication helps students find their place in society and participate actively and effectively in social environments. By developing communicative skills during the learning process, students take an active part in class discussions, ask questions, express opinions, and try to present their viewpoints during group work. For primary school students in particular, this skill is one of the fundamental pillars, as at this age

they learn to reason, ask questions, and listen to responses through interaction with those around them. [5]

Collaboration, or working together, refers to students' active participation in working as a team toward a common goal, sharing tasks, understanding responsibility, and contributing to a collective outcome. A collaborative approach helps students develop skills such as joint decision-making, solving problems as a group, and offering mutual support. Through activities like working in small groups and completing joint projects or assignments, students learn to listen to one another, express their opinions, and reach consensus with others. This process also instills values such as mutual respect, responsibility, leadership, and equality. Collaboration fosters skills that play a crucial role in both social and professional life in the future.

Creativity is the ability to think innovatively, generate new ideas, approach existing problems in unconventional ways, and make creative decisions. Creativity expands students' imagination, curiosity, and opportunities for self-expression. During lessons, creative thinking is encouraged through open-ended questions, imaginative tasks, and unusual problem-solving approaches. This increases students' interest in the lesson, motivates them to express their thoughts freely, and promotes their creative expression. It is especially important to nurture creativity at the primary school level, as this is the stage when children first begin to engage in active creative processes. [6]

In conclusion, each component of the 4K educational technologies is closely interconnected and plays a significant role in the personal, social, and cognitive development of students. These competencies serve as essential tools in nurturing individuals who meet the demands of modern society—those who are open to innovation, active, responsible, and creative. Introducing these approaches into the educational process at the primary school level can lay the foundation for reinforcing essential life skills in students.

The Concept of Mathematical Competence and Its Expression in Primary School Students Mathematical competence refers to a student's ability to apply knowledge, skills, and abilities related to mathematics in practical life. This concept encompasses not only memorization of mathematical knowledge but also the ability to apply that knowledge in real-life situations, solve problems, analyze, think logically, and make independent decisions. In the 21st century, readiness to work with numbers, formulas, quantities, order, logic, and relationships is considered one of the key

social competencies. Therefore, mathematical competence should be developed starting from the primary school stage. [7]

For primary school students, mathematical competence is expressed in the following areas:

- **Mastery of basic mathematical concepts:** Students acquire initial knowledge about numbers, numerals, arithmetic operations (addition, subtraction, multiplication, division), shapes, and measurements. This knowledge forms the basis for the development of their thinking and prepares them for studying other subjects at later stages.
- **Problem-solving skills:** In primary school, students learn to understand and solve mathematical problems. In this process, they analyze situations, think logically, and strive to find solutions through mathematical modeling. This competency is highly valuable in solving everyday life problems.

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Logical Thinking and Consistency: One of the key aspects of mathematical competence is the ability to think consistently and precisely, identify cause-and-effect relationships, and reason logically. Primary school students develop this skill through various logical exercises, sequences, and conditional problems. [8]

Use of Mathematical Language and Expression Tools: Students learn to work with numbers, mathematical symbols, diagrams, tables, and graphs. This helps them understand, analyze, and clearly explain information.

Application of Mathematics in Real-Life Situations: Activities such as calculating money during shopping, telling time, and measuring distance or weight are examples of how students can develop mathematical competence in their daily lives.

Creative Approach and Advanced Thinking: Mathematical competence is not limited to traditional knowledge. Students also develop the ability to solve problems in different ways, try out new methods, and draw the right conclusions from incorrect answers. This encourages them to be creative thinkers.

Thus, mathematical competence is a fundamental component of primary education, aimed at developing students' ability to think independently, analyze problems, and find solutions. In developing this competence, modern curriculum approaches, interactive methods, the use of 4K technologies, game-based methods, and visual materials play a crucial role. Through these means, students begin to perceive mathematics not just as an academic subject but as an

integral part of real life.

Teaching mathematical knowledge in primary school based on 4K technologies is rooted in modern pedagogical approaches. These approaches aim to cultivate deep knowledge and skills in students, enabling them to apply what they've learned in real-life situations, and encouraging logical and creative thinking. The 4K pillars — critical thinking, communication, collaboration, and creativity — have become the foundational principles of the educational process. In primary school mathematics lessons, these principles are reflected as follows:

Firstly, lessons based on 4K technologies increase student engagement. Students are no longer passive recipients of ready-made knowledge but become active seekers, problem-solvers, and creators of new ideas. For example, instead of solving traditional textbook problems, students are presented with real-life situational problems. This encourages independent thinking, inquiry, and critical reflection.

Secondly, special attention is given to enhancing communication during the learning process. Students work in small groups where they can freely express their ideas, listen to others, and learn to defend their opinions and engage in constructive discussions. For instance, solving a mathematical problem in multiple ways and discussing these methods within the group helps solidify understanding.

Thirdly, collaboration is applied as a key methodological approach. Through collaborative learning, students learn to study together, support one another, and make decisions collectively. For example, working on a project as a team, either in a physical environment or on digital platforms, using numbers, shapes, and graphs, allows students to develop interconnection skills and experience the process of integrating their thoughts with others.

Fourthly, methods that stimulate creativity are widely used. Students are encouraged to solve problems in diverse ways, offer their own strategies, and complete tasks that promote creative thinking through mathematical games and interactive applications. Activities such as creating stories with numbers, illustrating the animal world using geometric shapes, or role-playing based on a problem's scenario make learning mathematics more engaging and meaningful.[9]

In addition, to effectively implement 4K technologies, ICT (Information and Communication Technology) tools are actively used. With the help of interactive whiteboards, multimedia programs, online quizzes, and visual platforms, students' interest and motivation toward mathematics increase. These tools not only

help students acquire knowledge but also allow them to participate actively in the learning process.

In conclusion, teaching mathematical knowledge in primary school using methods based on 4K technologies contributes significantly to the personal and intellectual development of students. Through these methods, students evolve into individuals who can apply mathematics in real life, justify their ideas, understand their role and responsibility in a team, and, most importantly, become creative and independent thinkers.

RESULTS

According to the research results, the use of 4K technologies in mathematics lessons led to the following changes in students:

- Students' depth of thinking increased, and they began to approach questions with independent reasoning.
- Collaboration skills developed through group work.
- Students began to solve mathematical problems creatively using various methods.
- During lessons, students gained the habit of listening to each other, expressing opinions, and engaging in dialogue through Q&A.

CONCLUSION

In developing mathematical competence among primary school students, 4K educational technologies — critical thinking, communication, collaboration, and creativity — play a crucial role as key components of modern education. Through these approaches, students not only gain mathematical knowledge and skills but also develop the ability to:

- Apply them in real-life situations,
- Think logically and consistently,
- Make independent decisions,
- Work in teams,
- Freely express their thoughts,
- Solve problems with a creative approach.

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