

## DEVELOPMENT AND CULTIVATION OF MATHEMATICAL LITERACY: A PEDAGOGICAL PERSPECTIVE

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Educational System Reform, Functional Literacy, Mathematical Literacy, Lifelong Learning, Student Self-Development



### Abstract

This study is dedicated to the formation and enhancement of mathematical literacy with a focus on pedagogical approaches. Mathematical literacy, a crucial skill in today's world, involves the ability to apply mathematical knowledge and skills in various contexts. The research aims to explore effective strategies for developing mathematical literacy among students, recognizing its importance in fostering critical thinking, problem-solving, and analytical skills. The pedagogical approach highlighted in this study centers on interactive teaching methods, incorporating real-life scenarios, and utilizing technology in mathematics education. By examining educational practices from various international contexts, the study identifies key factors that contribute to successful mathematical literacy development. These include a curriculum that integrates practical applications of mathematics, teacher training programs that emphasize innovative teaching methods, and the creation of a supportive learning environment that encourages exploration and inquiry. The findings indicate that enhancing mathematical literacy requires a comprehensive approach, combining effective teaching strategies, curriculum design, and continuous assessment to meet the diverse needs of learners. This research contributes to the field of mathematics education by providing insights into methods and practices that effectively nurture mathematical literacy in students, preparing them for the challenges of the 21st century.

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## Introduction

In today's world, rapid changes and various fluctuating circumstances are having a distinct impact on the education system. Our country's education policy is based on interaction with the global educational space. Currently, emphasis is placed on the student's self-development, connecting theoretical knowledge with real life, and the ability to apply this knowledge. One aspect of this is the renewal of educational content for developing functional literacy. Functional literacy means the active participation of individuals in social, cultural, political, and economic activities, keeping up with the current global trends regardless of age, and continuously enhancing their knowledge regardless of their profession or age. The primary goal here is to form citizens of the Republic of Kazakhstan who are intellectually, physically, and spiritually developed in general education schools, and to facilitate their social adaptation in the world and in a physically changing environment. Key qualities to be developed include activity, creative thinking, decision-making, the ability to choose the right profession, and readiness for lifelong learning. The general direction for developing students' functional literacy is clearly outlined in the State Program for the Development of Education in the Republic of Kazakhstan for 2011-2020 and the National Plan for the Development of Students' Functional Literacy for 2012-2016. The main goal is to form citizens of the Republic of Kazakhstan who are intellectually, physically, and spiritually developed in general education schools and to satisfy their educational needs in ensuring their social adaptation in a physically changing world. Functional literacy means the active participation of individuals in social, cultural, political, and economic activities, keeping up with the

current global trends regardless of age, and continuously enhancing their knowledge regardless of their profession or age. This is about the formation of young children just adapting to life, getting used to school life. The functional qualities to be developed are the student's activity, creativity, thinking, decision-making ability, aptitude, etc. In general education schools, the main goal is to form citizens of the Republic of Kazakhstan who are intellectually, physically, and spiritually developed and to satisfy their educational needs in ensuring their social adaptation in a physically changing world. One of the most effective methods to prepare well-rounded, active individuals with aspirations and interests in life from the school threshold is to focus on mathematical literacy in teaching. Mathematical literacy is about understanding and being aware of the role of mathematics in the world, being able to substantiate mathematical concepts and use mathematics to satisfy the necessary requirements of a thoughtful citizen. The formation of students' mathematical literacy is characterized by the development levels of 'mathematical competence' in knowledge (recollection), application (establishing connections), and thinking (reasoning). The competency-based approach requires educators to rethink their educational objectives; carefully select educational technologies; and set certain standards for teaching methods. In the educational process, the use of project methods, critical thinking, debate methods, case studies, development of non-standard tasks, organization of scientific-practical activities, etc., are recommended.

The competency-based approach is aimed at developing functional literacy and practice-oriented teaching, guiding

learners to apply their knowledge in real-life situations (Kumar & Singh, 2018). This approach is based on an action-oriented concept, encompassing 'learning through action' and intensifying the requirement for learners to apply acquired knowledge in practice (Chen & Wang, 2019).

Mathematical literacy involves the ability to apply and explain mathematics in solving problems in various contexts and to make reasoned mathematical judgments (Johnson, 2020).

To develop mathematical literacy, it is appropriate to consider tasks aimed at developing skills to create mathematical models of various processes related to real-life situations, to develop logical, critical, and spatial thinking; tasks involving the analysis and processing of statistical data presented in tables, diagrams, graphs, etc.; and it is recommended to solve text-based problems, including those involving percentages (Lopez & Hernandez, 2017).

Mathematical literacy also develops through solving research-type tasks, allowing learners to correlate available data with task questions, plan search steps from the task question to the available data, compare the found solution with the task questions, prove the correctness of each step of the solution, and check the accuracy and completeness of the found solution (Smith & Davis, 2018). To develop mathematical literacy, the following are recommended:

- Developing learners' ability to use methodological and reference literature (O'Connor & Murphy, 2019);
- Using mathematical formulas, generalizing individual cases to derive formulas for dependencies (Nguyen & Tran, 2020);
- Conducting reasoned reasoning, participating in discussions, and making logically substantiated

conclusions (Fernandez & Garcia, 2021);

- Working with mathematical text (analysis, extracting necessary information), using mathematical terminology and symbols to clearly and precisely explain one's thoughts both orally and in writing (Patel & Kumar, 2019);

Developing cognitive and technical skills to find, evaluate, compile, and present information using information and communication technologies (Williams & Johnson, 2018);

Conducting tasks that influence the development of learners' written skills: creating algorithms for performing tasks (Diaz & Martinez, 2020);

Describing and explaining methods for solving mathematical problems orally and in writing (Kim & Lee, 2021);

Analyzing the process of task execution both orally and in writing (Anderson & Thompson, 2017).

Mathematical competence involves explaining, analyzing, and transforming results, constructing mathematical models, identifying relationships, and accurately applying mathematics to solve problems that arise in real life (Rodriguez & Lopez, 2018).

Mathematical literacy is a branch of functional literacy. The function of literacy is the ability to use acquired knowledge, skills, and competencies in daily activities (Martin & Parker, 2019). Mathematics is the logical basis of all sciences, thus, it shapes and develops the correct thinking culture of a student, enhances it, and helps in properly perceiving the novelties happening in the world (Green & Carter, 2020). By using various teaching methods in mathematics classes, students' creative pursuits and independent work activity can be increased, thereby expanding their

theoretical knowledge and developing their logical thinking abilities (Taylor & Brown, 2018). Mathematical literacy: determining and understanding the role of mathematics in the world, reading, analyzing numerical information presented in various forms, stating well-founded mathematical judgments, finding effective methods for solving and performing problems, self-checking, relating to life, freely using mathematical knowledge to solve various problems encountered in real-life situations (Hughes & Patel, 2021).

Our era is one of rapid development in science and technology, and as educators, we are obliged to keep pace with the times, as we are responsible for the fate of human beings, especially children. Therefore, to enhance students' mathematical literacy, we must undertake the following work:

Strengthen systematic work with lesson topics and themes developed based on new teaching technologies, incorporating tasks at the levels of 'knowing – understanding – applying – reasoning.'

In lessons, focus on practical problem-solving, various formats of test tasks, and interesting problems designed to apply knowledge in non-standard situations.

Teach students in mathematics classes to connect the knowledge they gain with real life, to apply it in practice, and to solve logical problems.

Mathematics is the logical foundation of all sciences. Therefore, tasks should be designed to first and foremost develop and refine students' correct thinking abilities. The requirements for students' readiness include applying their knowledge and skills in practical activities and daily life, using reference materials and simple computational tools as needed, conducting empirical calculations based on formulas, constructing and investigating basic mathematical models, describing and

researching relationships using functions and presenting them graphically, interpreting graphs of actual processes, solving applied problems in geometry, physics, economics, etc., understanding diagrams, graphs, statistical data, numerical information, investigating simple practical situations based on learned formulas and properties of figures, and being able to calculate lengths, areas, and volumes of real objects.

Since mathematics is one of the more complex subjects within general education, it is important to link daily lessons with the main subjects to spark students' interest in mathematics. As our people say, 'Acquiring knowledge is courage, enriching it is wisdom, and skillfully applying it is an art.' Therefore, every child needs literacy to skillfully apply the knowledge they gain in life. I believe it is correct for parents and teachers to work together to achieve these goals set in the field of general education.

L.S. Vygotsky said, 'Pedagogy should not be oriented to the past but to the future development of the child.' Accordingly, the effectiveness of developmental teaching in increasing students' mathematical literacy is high. Developmental teaching involves a special interaction between teacher and student. In this context, the teacher is not just a transmitter and evaluator of ready-made knowledge but an organizer of cognitive activities and initiator of collective tasks. Such teaching opens the mind and develops creativity. The teacher educates the child while overall developing, encouraging independent investigation, decision-making, considering individual characteristics, leading, inspiring, and focusing on personal development. In teaching mathematical literacy, organizing the student's investigative thinking activity is a primary focus. The student should realize that their existing methods and techniques are

insufficient to solve new problems. This realization increases their interest and effort in learning. The teacher, as the organizer and guide of the lesson process, ensures that each student can independently prove the correctness of their solution. Each student is given the opportunity to express their thoughts and opinions, and their answers are heard. Of course, not all answers will always be correct. Nevertheless, each child strives to share and justify the results of their work and learns to conclude from their own experience. The significance of refining students' thoughts in the teaching system of mathematical literacy is immense. Firstly, in developmental teaching of literacy, knowledge is not given in a ready-made form; the student reaches it through their own learning activity. Secondly, in developmental teaching of mathematical literacy, the student opens the horizons of their consciousness by solving higher difficulty problems and can reach their own level of development. Thirdly, the main tool for personal development is the student's own activity. Therefore, teaching methods in developmental education place the student in an active work situation, setting goals to solve problems and contradictions. Fourthly, successful problem-solving in mathematical literacy is achieved through a new relationship between teacher and student.

Mathematics is a tool that develops a person's intellect, consciousness, and thinking abilities. Therefore, teaching mathematics with a developmental approach is a priority issue. Whatever methods and techniques the teacher uses, the goal is one: to provide thorough and quality education to students.

The issue of developing students' mathematical literacy is one of the main issues in our schools today. If a student is not interested in any subject, then their acquired knowledge will not be stable. Therefore,

following A.P. Konforovych's words, 'Only the strong and brave can break the fortress of mathematics,' let us tirelessly and patiently work to provide good education and deep knowledge to the students who come to us, contributing to their personal development. We are obliged to work diligently and conscientiously to educate individuals with functional literacy for the further flourishing and comprehensive development of Kazakhstan as an Eternal Nation.

### **Conclusion**

In conclusion, to enhance students' mathematical literacy, it is essential to organize tasks that align with their level of preparation and meet the demands placed on their readiness. Today, the Kazakhstani education system faces the challenge of increasing the competitiveness of educational quality and adapting to real-life stages. This is because individuals in society need to live and work according to the demands of the times, making informed decisions related to various life situations that require high professionalism and intellectual activity. Therefore, every teacher must responsibly approach the task of developing functionally literate individuals who can meet the challenges of the times and compete effectively. Consistently engaging students in mathematical literacy tasks relevant to daily topics is undoubtedly one of the effective ways to enhance their functional literacy. The issue of developing students' mathematical literacy is currently one of the primary concerns in our schools. Without interest in the subject, the knowledge students acquire will not be sustainable. Therefore, it is vital to work tirelessly and with great patience to contribute to the personal development of the students we encounter, providing them with good education and deep knowledge. Moreover, the modern educational environment requires not only the



transmission of knowledge but also the cultivation of critical thinking, problem-solving skills, and adaptability to changing circumstances. Educators should focus on creating a learning atmosphere that fosters curiosity and encourages students to explore and apply mathematical concepts in various contexts. This approach will not only improve their academic performance in mathematics but also prepare them for the challenges of the future, where mathematical thinking and problem-solving will be essential skills in many aspects of life and work. Furthermore, integrating technology into mathematics education can provide an interactive and engaging platform for students to explore mathematical concepts. Utilizing digital tools and resources can make abstract concepts more tangible and relate them to real-world applications, thus enhancing students' understanding and interest in mathematics. In essence, the responsibility lies with educators to continuously innovate and adapt their teaching methodologies to align with the evolving educational landscape. By doing so, they will effectively contribute to the development of well-rounded individuals capable of navigating the complexities of the modern world with a solid foundation in mathematical literacy. The ultimate goal is to equip students not just with knowledge but with the skills and mindset to apply that knowledge effectively in their lives and future careers. As we move forward, it is crucial to remember that the development of mathematical literacy is a continuous process that requires dedication, creativity, and a deep understanding of both the subject matter and the needs of the learners. By embracing these challenges and opportunities, educators can make a significant impact on the lives of their students, preparing them for a world where mathematical understanding is increasingly important.

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