

**DEVELOPMENT OF ANALYTICAL THINKING IN REQUIREMENTS THROUGH
THE WORKS OF AL-KHORAZMI**

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Abstract: This article analyzes the importance of Al-Khorazmi's scientific heritage in the development of students' analytical thinking skills. The work examines the use of algorithmic approaches and mathematical models of the great scientist in the modern educational process and ways of their effective use. STEM-projects based on Al-Khorazmi's works, gamification and group work methods allow students to apply their theoretical knowledge in practice and develop creative and critical thinking skills. The article also describes the role of these approaches in increasing the effectiveness of education and their practical importance. This study shows how relevant Al-Khorazmi's works are in modern education and provides new pedagogical opportunities for the formation of students' analytical thinking skills.

Key words: Al-Khorazmi, analytical thinking, algorithmic approach, mathematical models, STEM-education, gamification, group work, modern education, creative thinking, critical thinking, educational effectiveness, pedagogical approaches.

Introduction. In the 21st century, with the development of information technologies and innovative approaches, the formation of students' analytical thinking skills has become a priority task of the education system. Analytical thinking skills include human skills to analyze logically, evaluate evidence, solve problems systematically and draw correct conclusions. The scientific heritage created in the golden age of oriental science, especially the works of Al-Khwarizmi, provides rich experience and methodological indications. Al-Khwarizmi made a great contribution to the development of world science, and his work "Al-Jabr and al-Mukabala" laid the foundation of the science of algebra. The algorithmic methods and mathematical models he created have high efficiencies in the development of systems thinking. His scientific works can go down as an integral part of the educational process not only at that time, but also today. The main part. The study of Al-Khorazmi's works in modern education allows students not only to consolidate theoretical knowledge, but also to develop practical skills through them. Therefore, the widespread introduction of the scientific heritage of Al-Khorazmi in the curricula creates the possibility of bringing the modern education system to a new level. Based on the works of Al-Khorazmi, the purpose is to illuminate science-based approaches on the significance, content and methods of developing analytical thinking skills in students. The practical role of this scientific heritage in the educational process and the prospects for its widespread implementation through innovative pedagogical methods are also considered. Al-Khorazmi is a great scientist who lived in the 9th century and left an indelible mark on the history of world science. He is not only the founder of algebra, but also the father of algorithm theory. Also known. "Computation and algorithms require a clear and systematic approach to problem-solving. I have tried to facilitate the difficulty in all mathematical fields by developing these methods." [1]. Reflects al-Khorazmi's role as the founder of algorithms. Al-Khorazmi's approach helps students create the initial steps of analytical thinking. Al-Khorazmi worked in Baghdad at the Bayt al-Hikma (House of the Wise), where he created his famous work Al-Jabr and al-Mukabala. This work was widespread not only in the East, but also in the Western world, and for centuries served as the main source for the development of algebra and mathematical analysis. "Any problem, if it can be expressed through a mathematical model, becomes much easier for it to find its solution" Highlights the importance

of mathematical modeling in the works of al-Khwarizmi. This approach serves as the basis for training students to apply theoretical knowledge in practical situations in modern education.

Literature review. The work "Al-Jabr and al-Mukabala" is considered the cornerstone of today's algebra science. In this work, Al-Khorazmi outlined the basic methods of systematic solution of mathematical problems. The work describes a method for solving the equations of the first and second order. Al-Khorazmi recommends solving these equations by simplifying them, i.e., by "agr" (converting negative elements in the equation into positive ones) and "alternative" (reducing the same elements in the equation). Al-Khorazmi showed the solution of economic and geometric problems in everyday life with the help of mathematical models. This forms the ability of students to apply theoretical knowledge in practice. Develops systems thinking by representing problems in the form of mathematical models. This process consists of breaking down the problems into small parts, identifying the important elements at each stage, and ultimately finding a complete solution. Analytical thinking requires solving problems through an integrated approach. Al-Khorazmi's works provide clear algorithmic steps for systematic problem solving, which helps students to approach each issue with a specific approach. Teaching students to solve life problems on the basis of mathematical modeling. Study of the works of al-Khorazmi through interactive and gamification elements. By its universality, the scientific heritage of al-Khorazmi can become an integral part of modern education. The development of analytical thinking in students through his works has a great impact not only on their academic and academic achievements, but also on their ability to effectively solve problems in everyday life. In this regard, the widespread introduction of Al-Khorazmi's works into the educational process should be one of the priorities of today's pedagogical approaches. Research methodology. In his works, al-Khwarizmi proposed algorithmic approaches to solving mathematical problems. Especially by grounding algebras and algorithms, he developed mathematics as a theoretical science. The main ways of developing algorithmic thinking based on the works of Al-Khwarizmi in the educational process are: students start by solving simple equations, and then move on to complex problems. Al-Khorazmi's methods make it possible to resolve issues gradually, in small steps. Students will test their solutions in real life by applying the algorithms they have learned. For example, the application of equations in the field of economics or engineering. Through this method, students learn to systematically analyze problems, justify each step and evaluate the effectiveness of their solution. Mathematical models and simulations teach students to understand real-life situations through a mathematical approach. The works of Al-Khorazmi are a powerful tool for the implementation of such an approach into practice: Students learn to understand life problems through mathematical expressions. For example, issues such as the division of land or the calculation of costs in matters of trade are modeled. Practical simulations of Al-Khorazmi algorithms are developed with the help of modern software. This will not only limit students to theoretical knowledge but also help them adapt to technology. For example, students will learn how to solve agricultural problems using Al-Khorazmi's land allocation algorithms. This approach encourages them to think scientifically and creatively. This process teaches students to interconnect theoretical and practical issues and increases their ability to effectively solve complex problems. Results of the study. Analytical classes teach students how to analyze problems, evaluate and draw conclusions based on the works of Al-Khorazmi. These classes include: Students are given the task of an in-depth study of important theoretical precepts taken from the works of Al-Khorazmi. This will not only increase their level of knowledge, but also develop their mathematical thinking. Students take a critical look at a particular algorithm or solution, identifying its effectiveness and weaknesses. For example, they solve a particular problem through several methods and analyze which method is more effective. Students will test each step in their own experience, applying theoretical

approaches in practice. This method strengthens their ability to think independently. Analytical activities teach students to think critically and make independent decisions. They will be able to effectively apply theoretical knowledge in practice[4].

Through the application of the works of Al-Khorazmi in the educational process, students will develop mathematical and algorithmic reasoning skills. They will not only be limited to the theoretical study of mathematics, but also acquire the ability to analyze, solve and apply real-life problems in practice. The use of modern innovative methods in integrating the works of Al-Khorazmi into the educational process is effective in activating students and developing their analytical thinking skills[5]. STEM education (science, technology, engineering and mathematics) is one of the main areas of today's education system and provides great opportunities for basing Al-Khorazmi's works on practical projects. Students are offered projects aimed at developing practical problems and solving them by studying Al-Khorazmi algorithms. For example, projects such as the division of geometric land plots or the modeling of trade issues will be developed. Each project develops not only theoretical knowledge of students, but also creative thinking skills. For example, students can create new problem models by applying algorithms. STEM projects shape students' skills in using technology and modern software. For example, testing Al-Khorazmi algorithms in applications such as Python or MATLAB[4]

Gamification is a way to make the educational process more interesting and productive through interactive games. The gamification approach in the study of the works of Al-Khorazmi involves students in the study of mathematical and algorithmic problems. Games based on Al-Khorazmi algorithms are developed for students. For example, the game "Algebra Master", in which students strive to solve equations faster and more efficiently. For students, a system of collecting points and rewarding during the game is introduced. This creates a competitive atmosphere and increases student engagement. Gamification games increase the level of complexity to match the level of knowledge of the students. This constantly develops their thinking capacity. Gamification encourages students to explore mathematical and algorithmic problems in a fun way by turning learning into a form of game[2]. Groupwork serves to encourage students to engage in interaction, exchange of ideas, and develop teamwork skills in the educational process. Students will discuss issues based on Al-Khorazmi algorithms in a group. For example, one team analyzes an algorithm mathematically, while another team develops ways to apply it in practice. This will increase collaboration between students. By working in a group, students not only develop their knowledge, but also learn new skills from each other and learn how to solve team problems. These innovative approaches will allow applying effectively the Al-Khorazmi scientific heritage in the process of modern education. It develops in students not only theoretical knowledge, but also technological skills. And through gamification, the educational process will be more interesting, easier for students to accept and more efficient. Group work develops teamwork and creativity.

Conclusion. Al-Khorazmi's scientific heritage holds a unique place not only in its time, but also in the modern education system, and his works are today an important source for the development of students' analytical thinking skills. The algorithmic approaches and mathematical models he has created create ample opportunities for students to systematically solve problems, evaluate evidence logically, and develop independent thinking skills. The implementation of Al-Khorazmi's works in curricula not only deepens theoretical knowledge, but also provides a practice-oriented approach. In parallel with this, students' technological literacy and teamwork skills will be developed. Modern educational technologies, including STEM projects, gamification and group work are important tools for the practical application of Al-Khorazmi's heritage Thanks to these approaches, students' interest in the learning process increases, their

learning effectiveness increases. Integration of Al-Khorazmi's works into the curricula on a large scale allows to raise the quality of education to a new level, adapting students to the complex and rapidly evolving problems of the modern world. Therefore, the full application of this scientific heritage in the educational process is a key factor for the preparation of highly skilled, logically thinking specialists for society.

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