ISSN 3041-1831 (print) Ідентифікатор медіа: R30-05068
ISSN 3041-184X (online) *Media identifier: R30-05068*
Вісник післядипломної освіти: збірник наукових праць. Серія «Педагогічні науки». Вип. 34(63). Категорія «Б»
Bulletin of Postgraduate education: collection of scientific papers. Educational Sciences Series. Issue 34(63). Category «B»
https://doi.org/10.58442/3041-1831-2025-34(63)

https://doi.org/10.58442/3041-1831-2025-34(63)-180-197
UDC 372.851

Jamala Nabiyeva,
PhD Candidate in Pedagogical, Associate Professor
at the Department of Computer Engineering of the
Azerbaijan State Oil and Industry University.
Baku, Azerbaijan.
https://orcid.org/0000-0002-4613-1642
camala157@mail.ru

IMPLEMENTATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN MATHEMATICS TEACHING AND ITS ROLE IN INTERACTIVE LEARNING

Abstract. The modern educational system is undergoing a transition toward the development and use of information and communication technologies in education. In this field, numerous research studies are being conducted both in Azerbaijan and abroad. With the emergence of computers and their application in educational institutions, the teaching process gradually began to change. According to theory, computerization should not only contribute to the development of students' personalities and creative abilities but also fundamentally transform the entire educational technology. The implementation of information and communication technologies in education leads to a significant restructuring of the educational process and, as a result, to the development of appropriate methodological support for the use of computer technologies at all levels of education. The information technologies used in mathematics should help students comprehensively master mathematical tools and strive to apply these tools to problems in physics and technology. The current stage of purposeful and consistent reforms in Azerbaijani education sets new and higher requirements for teachers to master modern teaching methods and technologies, as well as for their overall professional and methodological training. In order to prepare teachers who meet these requirements, intensive research is being conducted in higher pedagogical institutions to improve the forms and methods of organizing instruction. These studies can be divided into two groups: the first concerns general problems of teacher training, while the second addresses issues related to teacher preparation in specific subjects. In general, a number of studies have been conducted on teachers' professional training, the formation of personal qualities in professional activities, and the development of

ISSN 3041-1831 (print) Ідентифікатор медіа: R30-05068
ISSN 3041-184X (online) *Media identifier: R30-05068*
Вісник післядипломної освіти: збірник наукових праць. Серія «Педагогічні науки». Вип. 34(63). Категорія «Б»
Bulletin of Postgraduate education: collection of scientific papers. Educational Sciences Series. Issue 34(63). Category «B»
https://doi.org/10.58442/3041-1831-2025-34(63)

professional and special skills. The problem of improving the quality of teaching mathematical disciplines belonging to the group of fundamental subjects is frequently discussed in modern methodological publications. However, the reasons for students' low levels of knowledge often remain overlooked; the subjects, courses, and sections that are poorly mastered by students are not identified and no specific teaching methodologies are developed to address these deficiencies. Therefore, the development of teaching methodologies for subjects, courses and sections within courses is considered one of the current issues. All of the above directly applies to the Higher Mathematics course, which is regarded as one of the fundamental mathematical disciplines in the training of mathematics teachers at higher pedagogical institutions. The Higher Mathematics course occupies an important place in the curriculum for future mathematics teachers, as it serves as a foundation for studying other mathematical disciplines, enables a deeper understanding and mastery of these subjects and plays a crucial role in developing students' general intellectual level and worldview. Higher Mathematics, among the series of mathematical disciplines, is distinguished by its operations with more complex and multifaceted concepts and propositions. By its nature, Higher Mathematics allows for broad generalizations, the derivation of conclusions and the unification of various studied processes into a single form through the use of a system of universal methods and rigorous mathematical concepts that enable the modeling of different processes and their applications across various fields of knowledge. Therefore, improving the methodological system for teaching this discipline is essential. At the same time, it is well known that in recent decades the volume of information has been increasing rapidly. Under such circumstances, the study of new ways and means of enhancing the efficiency of the teaching process aimed at improving the mathematical training of future mathematics teachers remains an important issue to be addressed.

Keywords: modern education; information and communication technologies; mathematics teaching; Higher Mathematics; teacher training; pedagogical technologies; mathematical modeling; methodological system; efficiency of the teaching process.

INTRODUCTION / ВСТУП

Statement of the problem / Постановка проблеми. With the transition to an information society, introducing the younger generation to information has become increasingly important, and this process is an integral part of education.

ISSN 3041-1831 (print) Ідентифікатор медіа: R30-05068
ISSN 3041-184X (online) *Media identifier: R30-05068*
Вісник післядипломної освіти: збірник наукових праць. Серія «Педагогічні науки». Вип. 34(63). Категорія «Б»
Bulletin of Postgraduate education: collection of scientific papers. Educational Sciences Series. Issue 34(63). Category «B»
https://doi.org/10.58442/3041-1831-2025-34(63)

The key challenges, paths, and stages of informatization in education, social, and industrial spheres largely coincide with the general principles of informatization of society as a whole.

Informatization of society is a socio-economic and scientific-technical process carried out in order to meet the information needs of citizens, state authorities and local governments, organizations and public institutions and the implementation of information rights based on the formation and use of information resources. An information society is one in which the majority of its members are engaged in the production, storage, processing, and use of information. The use of modern educational technologies in mathematics teaching is understood as a set of optimal didactic processes in this subject, a set of methods for achieving goals and solving educational problems. The goal is to achieve learning outcomes by stimulating the student's thinking, knowledge, skills, behavior, and emotions. Any technology, in one way or another, is aimed at the practical implementation of scientific ideas, propositions, and theories. Pedagogical technology occupies a middle ground between science and practice [9, p. 13–19].

Modern society has entered a historical process known as informatization. This process is realized through computerization. Informatization plays a crucial role in the education of the younger generation, serving as the primary source of scientific, technological, and socioeconomic development. As a result of informatization and computerization, the use of ICT has become a necessity. ICT is essentially a field encompassing a wide range of technologies related to the acquisition, storage, reuse, and protection of information. Research conducted in the field of ICT has established that an information system consists of the following interrelated components:

Computerization is the selection of all socially significant information, primarily from electronic media, and its storage, processing, transmission, and presentation in a convenient form. Computerization of education is a rather complex process that requires time and is implemented in stages:

- Widespread implementation of ICT tools – the creation of computer labs, telecommunications equipment, online publications, interactive display systems, and the implementation of the fundamental rights of teachers and students to use databases and software;
- Revise educational content to incorporate the widespread use of ICT tools in teaching subjects, and provide graphic and audio materials on CDs;
- It is necessary to fundamentally restructure the continuous education system, introduce distance learning, and change the methodological foundations of teaching.

ISSN 3041-1831 (print) Ідентифікатор медіа: R30-05068
ISSN 3041-184X (online) *Media identifier: R30-05068*
Вісник післядипломної освіти: збірник наукових праць. Серія «Педагогічні науки». Вип. 34(63). Категорія «Б»
Bulletin of Postgraduate education: collection of scientific papers. Educational Sciences Series. Issue 34(63). Category «B»
https://doi.org/10.58442/3041-1831-2025-34(63)

In recent years, the terms "computer technology" and "information technology" have become widely used. The concepts of "information" and "technology" are at the core of ICT [11, p. 239–258]. Let's clarify some concepts related to computer technology. Technology is the sum of knowledge about the means and methods of production processes that enable qualitative changes to the object being processed. Information in nature is transmitted as signals and is divided into two types: analog and digital. Humans process analog information through their senses, while computers process digital information. Thus, analog information is described as it is perceived by the human senses, while digital information is information processed by a computer and expressed in codes.

Information is knowledge and data about people, living beings, inanimate objects, facts, events, processes, etc., regardless of the form of expression. Knowledge is expressed in the form of specific facts and the relationships between them. Information can be created, transmitted, stored, and processed.

For information to be usable, the following conditions must be met:

- Completeness – must be described in full;
- Accuracy – must reflect reality;
- Value – must be achieved with minimal effort;
- Significance – must be important to the user;
- Relevance – must meet current requirements;
- Clarity – must be prepared in a form understandable to the user.

An information process is defined as the collection, processing, and transmission of information [14, p. 275–294].

Information technology is a set of methods, production processes, and hardware and software that enable the collection, transmission, storage, processing, and provision of information to users, linking them into a technological chain to reduce the labor intensity of information resource use and improve their reliability and efficiency. Information technology is understood as the technology used in software-controlled devices and computing equipment of any facility. The introduction of computers into the information environment and the use of telecommunications have taken the development of information technology to a new level [11, p. 239–258].

Thus, a new stage in the development of information technology has begun. Information is transformed into the required form through the use of modern information technologies. On the other hand, information technologies are viewed as an important component of society's use of information resources.

ISSN 3041-1831 (print) Ідентифікатор медіа: R30-05068
ISSN 3041-184X (online) *Media identifier: R30-05068*
Вісник післядипломної освіти: збірник наукових праць. Серія «Педагогічні науки». Вип. 34(63). Категорія «Б»
Bulletin of Postgraduate education: collection of scientific papers. Educational Sciences Series. Issue 34(63). Category «B»
https://doi.org/10.58442/3041-1831-2025-34(63)

Analysis of (major) recent research and publications / Аналіз (основних) останніх досліджень і публікацій. The problem of improving the quality of teaching mathematical subjects, which are fundamental educational disciplines, is often discussed in modern methodological publications. However, the reasons for students' poor knowledge remain obscure; subjects, courses, and sections that students are poorly comprehending are not identified, and teaching methods for them are not developed. Therefore, developing teaching methods for subjects, courses, and sections is considered a pressing issue.

All of this directly relates to the course in higher mathematics, which is considered one of the core mathematical subjects in the training of mathematics teachers at higher pedagogical educational institutions. Higher mathematics occupies an important place in the training program for future mathematics teachers: it serves as a foundation for studying other mathematical subjects, fostering a deeper understanding and mastery of them, and is crucial for developing students' overall intellectual level and shaping their worldview.

It should be noted that a certain number of studies have been conducted in the Republic of Azerbaijan devoted to the problem of improving the quality of training of future mathematics teachers. In this area, the studies of mathematicians and methodologists A. Adygozalov [1], I. Gurbanov [2], A. Mekhrabov [3], A. Palengov [4], M. Makhmudov [5] and others deserve special mention.

AIM AND TASKS / МЕТА ТА ЗАВДАННЯ

The ***aim*** of the study is to investigate the scientific and methodological foundations of the application of information and communication technologies (ICT) in the modern education system, to determine the impact of these technologies on the effectiveness of the educational process, especially on the teaching of mathematics in higher education institutions, as well as to scientifically substantiate the directions for improving the professional and methodological training of future teachers.

To achieve this goal, the following ***objectives*** were set for the study:

1. To analyze the theoretical and methodological foundations of the application of information and communication technologies in the modern education system;
2. To determine the content and directions of the informatization process in education and the mechanisms of its impact on the pedagogical system;
3. To examine the pedagogical and methodological features of the application of ICT in mathematics teaching;

ISSN 3041-1831 (print) Ідентифікатор медіа: R30-05068
ISSN 3041-184X (online) *Media identifier: R30-05068*
Вісник післядипломної освіти: збірник наукових праць. Серія «Педагогічні науки». Вип. 34(63). Категорія «Б»
Bulletin of Postgraduate education: collection of scientific papers. Educational Sciences Series. Issue 34(63). Category «B»
https://doi.org/10.58442/3041-1831-2025-34(63)

4. To systematize new requirements for teachers' professional and methodological activities, creative abilities, and teaching strategies in the modern educational environment;

5. To determine the forms and models of using information technology in the training of mathematics teachers in higher education;

6. To assess the impact of the application of ICT in mathematics teaching on students' scientific and cognitive activity, analytical thinking, and motivation.

THEORETICAL FRAMEWORK / ТЕОРЕТИЧНІ ОСНОВИ

In today's world, the use of information and communication technologies (ICT) in education has become an integral part of the learning process. It is now impossible to imagine educational institutions without ICT. The use of computers in education helps create an information environment for students who are curious about everything and eager to learn more and more deeply. Computers act as an electronic intermediary between teacher and student, making the learning process more engaging, engaging, visual, and intensifying. It is well known that the introduction of a modern interactive education model using ICT places new demands on schools and teaching staff. Effective use of ICT in the education system is impossible without improving the ICT literacy of teaching staff and developing an innovative approach to the learning process. Successful and effective implementation of all the changes arising from the demands of the modern era in schools automatically entails a different approach to the learning process for teachers. Therefore, mastering ICT by teachers and using it as a pedagogical tool in the educational process is currently essential. Today's teachers face the following challenges:

- Must teach students learning methods, develop their ability to freely search for necessary information from relevant sources, and, without wasting time, systematize the information found and select the most useful information, analyze the selected information, and express their personal attitude to the problem, making the information their own;
- Must instill in students a sense of self-confidence and develop the ability to freely present their ideas to an audience;
- Must constantly guide students toward the use of new information technologies to implement the above in the teaching of any subject.

With the help of information and communication technologies, students strive to freely access information, developing their thinking and psychological skills. Most importantly, students become active participants in the educational process. Furthermore, the use of computer technology frees teachers from the

ISSN 3041-1831 (print) Ідентифікатор медіа: R30-05068
ISSN 3041-184X (online) *Media identifier: R30-05068*
Вісник післядипломної освіти: збірник наукових праць. Серія «Педагогічні науки». Вип. 34(63). Категорія «Б»
Bulletin of Postgraduate education: collection of scientific papers. Educational Sciences Series. Issue 34(63). Category «B»
https://doi.org/10.58442/3041-1831-2025-34(63)

role of the sole source of reliable information for students; they become co-authors with the students. The use of ICT in the educational process has also created numerous opportunities for teachers. They save time in class, convey information accurately, utilize various technical teaching aids simultaneously, convey a greater volume of information, and simulate various processes, especially those that cannot be implemented in school laboratories [16, p. 3–24].

Furthermore, it presents information in any form—graphs, tables, drawings—and helps teachers utilize and apply teaching methods developed by colleagues, using existing work in accordance with the lesson topic. These attributes make ICT-based learning superior to traditional methods. Teachers now emphasize that the use of ICT in teaching yields positive results. Thus, since the use of new technologies in teaching enlivens the lesson, even the weakest student in the class is not left out. Increasing interest in a lesson through the use of information technology allows for capturing the attention of any student. Overall, computers have gradually ceased to be merely a teaching tool within a computer science course and have become a powerful tool for developing the entire educational system. The results obtained through the systematic application of information technology in education demonstrate that it is completely transforming the educational environment, taking the learning process to a new level. The widespread and comprehensive use of information and communication technologies is transforming human activity and society as a whole, creating entirely new realities, values, and socio-psychological environments. All stages of a modern lesson should be structured to suit the interests and age of the student.

It's hard to imagine a modern classroom without ICT. When we think of a modern classroom, we primarily imagine a teacher proficient in ICT and a classroom equipped with a computer and projector that meets modern requirements. With the help of information and communication tools, students develop both intellectual and creative abilities, as well as skills in working with various types of information. In today's world, teachers are required to use methods that build on students' personal qualities. Teachers must effectively utilize ICT to prepare lessons that meet modern requirements throughout the learning process. They must also encourage students to acquire creative knowledge through the effective use of the internet, prioritizing the use of online resources in the classroom.

Electronic visual aids are a resource for subject teachers, providing methodological support in lesson preparation. One of the advantages of electronic lessons is that all lesson stages are reflected in slides. This increases the effectiveness and interest of the lesson. Using a smart board—one of the latest ICT

ISSN 3041-1831 (print) Ідентифікатор медіа: R30-05068
ISSN 3041-184X (online) *Media identifier: R30-05068*
Вісник післядипломної освіти: збірник наукових праць. Серія «Педагогічні науки». Вип. 34(63). Категорія «Б»
Bulletin of Postgraduate education: collection of scientific papers. Educational Sciences Series. Issue 34(63). Category «B»
https://doi.org/10.58442/3041-1831-2025-34(63)

advances—in the classroom increases student attention and interest in the lesson process, encouraging them to search for information [5].

It should be noted that digital educational resources cannot be presented in written form. Otherwise, their didactic qualities will be lost. In traditional methods, the teacher is accustomed to imparting and demanding specific knowledge, but with interactive learning, the student plays a central role, paving the way for knowledge acquisition. This also influences their motivation to learn. In this situation, the teacher acts as an active facilitator, and their primary function is to organize and stimulate the educational process.

The computerization of education and the use of new pedagogical technologies are enriching traditional education with new nuances. In traditional education, two active participants—the teacher and the student—are involved in creating information interactions in terms of feedback. In ICT-enabled learning, with immediate feedback, a new interactive partner is formed between the teacher and the student. The teacher ceases to be a source of information for the student. The teacher's ability to provide feedback and assess student knowledge is gradually limited, and some of this capacity is transferred to ICT. At this time, the teacher functions more as a consultant-tutor.

Teachers don't waste time transmitting information to their students. Time is not wasted on such stages as distributing educational materials to students or receiving individually mastered educational materials from them (checking assignments, taking lesson notes, etc.). In this freed-up time, students are able to solve other creative problems. Thus, the structure of educational and information interactions gradually changes, and as the information and educational environment develops, new levels of information exchange opportunities arise between the teacher, students, and ICT tools.

The primary goal of implementing new pedagogical technologies is to develop students capable of implementing the principles of democratization, humanization, individualization, integration, and humanism, in line with modern requirements, and to shape a generation possessing intellectual richness and potential. At the current stage of reforms and educational development in our country, the primary focus is on modernizing educational content in accordance with the stated objectives and implementing them using new pedagogical technologies.

Leading educators, drawing on global experience, integrate the principles of student-centered learning, active learning, developmental learning, preventative learning, educational flexibility, collaboration, and dialogic learning into the educational process. The primary focus of pedagogical technologies is on the accurate acquisition of knowledge about innovations, current concepts, and the

ISSN 3041-1831 (print) Ідентифікатор медіа: R30-05068
ISSN 3041-184X (online) *Media identifier: R30-05068*
Вісник післядипломної освіти: збірник наукових праць. Серія «Педагогічні науки». Вип. 34(63). Категорія «Б»
Bulletin of Postgraduate education: collection of scientific papers. Educational Sciences Series. Issue 34(63). Category «B»
https://doi.org/10.58442/3041-1831-2025-34(63)

most effective application of modern teaching principles and methods. The innovativeness of teachers using new pedagogical technologies, their identification of new teaching methods and lesson plans, drawing on global experience, creates broad opportunities for educational development. New pedagogical technologies are based on active (interactive) learning [8, p. 155–158].

Interactive learning is determined by the aforementioned components. These include content, methods, the learning environment, and the assessment of active learning. Interactive learning is a teaching method that plays a key role in developing teacher and student work ethic, as well as student thinking. It creates the conditions for developing a nurturing environment for students. It enhances the effectiveness of the learning process, serves as a supportive tool for achieving results through the use of innovation, guides students toward interest and activity, and plays a leading role in achieving goals. During the lesson, students are encouraged to apply acquired knowledge and skills, to justify and defend their own opinions, and to develop independent thinking skills. The main advantages of active learning are student engagement, their independent acquisition and assimilation of knowledge, the realization of their abilities, and their initiative.

Education reforms require improving the content of modern lessons and the use of new educational technologies. The use of interactive teaching methods has a positive impact on the quality of education. Today, students need to be given more independence in the educational process, creating conditions for free and uninhibited expression of opinions and choosing activities that align with their desires and aspirations. The use of new teaching methods and technologies in education leads to improved results and develops student qualities such as independence, business acumen, active thinking, and responsibility. Modern lessons conducted using new educational technologies offer many advantages over traditional lessons.

In a traditional lesson, students merely memorize information without drawing independent conclusions, receiving knowledge in a pre-packaged form. Educational activity is primarily driven by the teacher. Information becomes knowledge when it is understood and applied in real life. Student response requirements are based not on testing knowledge acquisition, but on memorizing the information provided. Moreover, traditional learning does not provide students with adequate opportunities to imagine the practical application of knowledge. Lesson content is typically taught in an overly theoretical manner and is not adapted to real-life needs. This reduces the effectiveness of learning, as its quality directly depends on psychological factors such as the student's level of mental faculties and memory, and the presence or absence of cognitive motivation.

ISSN 3041-1831 (print) Ідентифікатор медіа: R30-05068
ISSN 3041-184X (online) *Media identifier: R30-05068*
Вісник післядипломної освіти: збірник наукових праць. Серія «Педагогічні науки». Вип. 34(63). Категорія «Б»
Bulletin of Postgraduate education: collection of scientific papers. Educational Sciences Series. Issue 34(63). Category «B»
https://doi.org/10.58442/3041-1831-2025-34(63)

Thus, when using traditional teaching methods, students' cognitive activity is passive and repetitive. One of the most complex problems of the traditional education system is the inflexibility of the pedagogical technologies used. The main challenge facing education in the modern information and communication age is that the body of knowledge accumulated in various fields of science is growing so rapidly that it is becoming virtually impossible to convey and assimilate it using traditional teaching methods and principles. While previously two primary sources of knowledge (teacher and textbook) were sufficient for a student to acquire knowledge, today these sources are inferior compared to numerous sources of information. Therefore, one of the primary goals of modern education is to teach students how to learn—that is, to teach students to acquire knowledge independently. Only through a qualitative change in teaching methods, focusing on the individual and their needs, and actively integrating creative thinking in the learning process can learning be highly effective. Furthermore, a personality-centered learning process will also influence the quality of educational processes: it will foster cognitive and social engagement, value orientations, and personal skills. Given these requirements, it is entirely logical to favor active and interactive learning technologies that combine productive, creative thinking with methods for independently acquiring new knowledge [12, p. 91–11].

An active (interactive) lesson differs from a traditional lesson in that children absorb knowledge themselves, are active, and are engaged in the learning process. The teacher acts as a guide but does not dominate the classroom. The classroom atmosphere encourages freedom, and children are not afraid to express their opinions. Although an active (interactive) lesson differs from a traditional lesson, it has a clear structure and allows for problem-solving. Children learn knowledge without compromising the curriculum. The main advantage of active (interactive) learning is the development of genuine cognitive motivation (the desire to acquire knowledge). This motivation is based on the ability to resolve real contradictions in students' thinking during cognitive activity. The emotions arising from real contradictions mobilize mental resources, stimulate cognitive activity, and enable prolonged concentration. One of the key features of a modern lesson is student engagement, which is achieved through interactive (active) teaching methods and ICT.

RESEARCH METHODS / МЕТОДИ ДОСЛІДЖЕННЯ

The methodological basis of the study consists of a set of principles, methods, theoretical propositions, and tools used to study, understand, and change pedagogical facts, phenomena, and processes.

ISSN 3041-1831 (print) Ідентифікатор медіа: R30-05068
ISSN 3041-184X (online) *Media identifier: R30-05068*
Вісник післядипломної освіти: збірник наукових праць. Серія «Педагогічні науки». Вип. 34(63). Категорія «Б»
Bulletin of Postgraduate education: collection of scientific papers. Educational Sciences Series. Issue 34(63). Category «B»
https://doi.org/10.58442/3041-1831-2025-34(63)

To address the objectives, the following research methods were used: theoretical analysis, observation, and interviewing.

RESEARCH RESULTS / РЕЗУЛЬТАТИ ДОСЛІДЖЕННЯ

The following key findings were obtained in relation to the research problem:

1. Significant substantive potential has been demonstrated for developing creative independence in the integration, application, and professional development of the issue of preparing a competitive future specialist to solve professionally oriented problems;

2. In the study of mathematics, the Mathematica computer system allows for expanded presentation of educational information, increased clarity of learning, a more complete understanding of the relationships between analytical expressions and their geometric representations, and the visualization of mathematical objects on the computer screen;

3. Solve basic mathematical problems and develop algorithms for their solution, effectively organizing students' independent work. Based on an analysis of various approaches to acquiring new knowledge, as well as the needs and interests of participants in the educational process, a conclusion has been drawn regarding the full implementation of the aforementioned didactic capabilities of the Mathematica computer system in the electronic textbook developed in 2012.

4. The created and tested electronic textbook is an effective means of developing creative independence, as it allows students to independently study a course or a separate section, simulating the main types of future professional activity.

CONCLUSIONS / ВИСНОВКИ

An objective analysis of the potential application of this methodological model in lecture-seminar systems shows that an electronic textbook based on the CMS Mathematica can become an integral part of the educational process, significantly transforming the traditional education system and elevating it to a qualitatively new level. Working with an electronic textbook introduces an important element of self-education into the learning process, changing its style and nature, enhancing the visual perception of the material, and increasing the level of informational content. The learning process becomes more individualized, tailored to the individual needs of students, and thus student-centered. An electronic textbook allows teachers to shift from expository and illustrative teaching, which emphasizes searching, processing, comprehending, and applying information, to teaching independent creative activity, diversifying

ISSN 3041-1831 (print) Ідентифікатор медіа: R30-05068
ISSN 3041-184X (online) *Media identifier: R30-05068*
Вісник післядипломної освіти: збірник наукових праць. Серія «Педагогічні науки». Вип. 34(63). Категорія «Б»
Bulletin of Postgraduate education: collection of scientific papers. Educational Sciences Series. Issue 34(63). Category «B»
https://doi.org/10.58442/3041-1831-2025-34(63)

classroom activities without overloading students with additional workloads, and increasing the proportion of independent work.

An analysis of psychological and pedagogical literature and the course of the study revealed that an important aspect of developing the creative independence of future engineers is the professional focus of mathematics instruction, which is implemented in the process of its organization.

The application of a didactic model and the solution of professionally oriented tasks developed to develop the creative independence of students at technical universities in mathematics instruction using the Mathematica computer system, based on the integration of knowledge in mathematics and computer science, including an electronic textbook in the Mathematica system, allows us to identify the stages, methods, and criteria for developing creative independence, as well as to assess the levels of development of creative independence in future engineers.

To effectively utilize the broad potential of ICT in education for organizational, scientific, methodological, etc. A set of strategic and conceptual documents should be prepared to address aspects of training and professional development for education system personnel for the informatization of education, equipping educational institutions with ICT equipment and creating a service infrastructure, ensuring the security of the informatization of education, and developing a regulatory framework, scientific, and educational support.

Continue the effective integration of ICT into education management, and implement information management mechanisms by creating a unified education information system. To this end, expand the use of the Electronic Document Management System and, as a result, increase the transparency of education system management.

Prospects for further research in this direction / Перспективи подальших досліджень у цьому напрямі. To fully utilize the potential of ICT in improving the quality of the education system, all secondary schools and higher education institutions in the country must be equipped with ICT infrastructure, and the necessary conditions must be created to ensure its use.

REFERENCES / СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ

[1] A. S. Adıgözəlov, *Məktəbdə riyaziyyat təliminin nəzəri əsasları*. Bakı, Azərbaycan : ADPU, 2018. [Online]. Available: http://web2.anl.az:81/read/page.php?bibid=590391&pno=1&lang=ru Application date: September 05, 2025.

[2] İ. Ə. Qurbanov, A. İ. Qurbanov, *Riyazi proqram paketləri*. Bakı, Azərbaycan, 2005. [Online]. Available: https://adpuquba.edu.az/wp-

content/uploads/2020/12/RIYAZI-PROQRAM-PAKETL%C6%8FRI.pdf
Application date: September 05, 2025.

[3] A. Mehrabov, Ə. Abbasov, Z. Zeynalov, R. Həsənov, *Pedaqoji texnologiyalar.* Bakı, Azərbaycan, 2006.

[4] Ə. Q. Pələngov, M. V. Abdullayeva, *Orta məktəbdə informatikanın tədrisi.* Bakı, Azərbaycan : Elm və Təhsil, 2015. [Online]. Available: http://web2.anl.az:81/read/page.php?bibid=vtls000693438
Application date: September 05, 2025.

[5] M. C. Mahmudov, Ali cəbr və xətti cəbrin elementləri. Bakı, Azərbaycan : AzTU, 2004.

[6] Ə. X. Paşayev, F. A. Rüstəmov, *Pedaqogika*. *Yeni kurs.* Bakı, Azərbaycan : Nurlan, 2007.

[7] F. A. Rüstəmov, T. Y. Dadaşova, *Ali məktəb pedaqogikası*. Bakı, Azərbaycan : Nurlan, 2007.

[8] A. P. Rovai, L. D. Grooms, «The relationship of personality-based learning style preferences and learning among online graduate students», *Journal of Computing in Higher Education,* vol. 16, pp. 30–47, 2004. [Online]. Available: https://link.springer.com/article/10.1007/BF02960281
Application date: September 05, 2025.

[9] A. Santo-Sabato, M. Vernaleone, «From the First Generation of Distance Learning to Personal Learning Environments: An Overall Look», *E-Learning, E-Education, and Online Training*, № 138, pp. 155–158, 2014. https://doi.org/10.1007/978-3-319-13293-8_19

[10] Tu. Chih-Hsiung, L. Sujo-Montes, Ch. -J. Yen, J. -Yi. Chan, M. Blocher, «The Integration of Personal Learning Environments & Open Network Learning Environments», *TechTrends*, vol. 56, is. 3, pp. 13–19, 2012. https://doi.org/10.1007/s11528-012-0571-7

[11] G. R. Pik, «Students' Personality Types, Intended Majors, and College Expectations: Further Evidence Concerning Psychological and Sociological Interpretations of Holland's Theory», *Research in Higher Education*, vol. 47, is. 7, pp. 801–822, 2006. https://doi.org/10.1007/s11162-006-9016-5

[12] G. Ritella, K. Hakkarainen, «Instrumental genesis in technology-mediated learning: From double stimulation to expansive knowledge practices», *International Journal of Computer-Supported Collaborative Learning*, vol. 7, is. 2, pp. 239–258, 2012. https://doi.org/10.1007/s11412-012-9144-1

[13] H. I. Strømsø, I. Bråten, «The role of personal epistemology in the self-regulation of internet-based learning», *Metacognition and Learning*, vol. 5, is. 1, pp. 91–111, 2010. https://doi.org/10.1007/s11409-009-9043-7

ISSN 3041-1831 (print) Ідентифікатор медіа: R30-05068
ISSN 3041-184X (online) *Media identifier: R30-05068*
Вісник післядипломної освіти: збірник наукових праць. Серія «Педагогічні науки». Вип. 34(63). Категорія «Б»
Bulletin of Postgraduate education: collection of scientific papers. Educational Sciences Series. Issue 34(63). Category «B»
https://doi.org/10.58442/3041-1831-2025-34(63)

[14] *Knowledge management e e-learning in ambito sanitario* / M. Masoni, M. R. Guelfi, A. Conti, G. F. Gensini. Milan, Italy: Springer, 2011.
[15] M. Webb, «Pedagogy with information and communications technologies in transition», *Education and Information Technologies*, vol. 19, is. 2, pp. 275–294, 2012. https://doi.org/10.1007/s10639-012-9216-x
[16] A. M. Colman, *A Dictionary of Psychology*. Oxford University Press, 2009. [Online].
Available: https://www.researchgate.net/publication/280097882_A_Dictionary_of_Psychology Application date: September 05, 2025.
[17] P. Sharma, S. Fiedler, «Supporting self-organized learning with personal Webpublishing technologies and practices», *Journal of Computing in Higher Education*, vol. 18, is. 2, pp. 3–24, 2007. https://doi.org/10.1007/BF03033411
[18] R. L. Gilbert, J. A. Foss, N. A. Murphy, «Multiple Personality Order: Physical and Personality Characteristics of the Self, Primary Avatar and Alt», in *Reinventing Ourselves: Contemporary Concepts of Identity in Virtual Worlds.* London, England : Springer, 2011, pp. 213–234. https://doi.org/10.1007/978-0-85729-361-9_11

Text of the article was accepted by Editorial Team 26.10.25

ВПРОВАДЖЕННЯ ІНФОРМАЦІЙНО-КОМУНІКАЦІЙНИХ ТЕХНОЛОГІЙ У ВИКЛАДАННІ МАТЕМАТИКИ ТА ЇХ РОЛЬ В ІНТЕРАКТИВНОМУ НАВЧАННІ

Набієва Джамала Орудж гизи,
кандидат педагогічних наук,
доцент кафедри комп'ютерної інженерії
Азербайджанського державного університету
нафти та промисловості.
Баку, Азербайджан.
https://orcid.org/0000-0002-4613-1642
camala157@mail.ru

Анотація. Сучасна система освіти переживає перехід до розвитку та використання інформаційно-комунікаційних технологій в освіті. У цій галузі проводяться численні дослідження як в Азербайджані, так і за кордоном. З появою комп'ютерів та їх застосуванням у закладах освіти, процес навчання поступово почав змінюватися. Згідно з

ISSN 3041-1831 (print) Ідентифікатор медіа: R30-05068
ISSN 3041-184X (online) *Media identifier: R30-05068*
Вісник післядипломної освіти: збірник наукових праць. Серія «Педагогічні науки». Вип. 34(63). Категорія «Б»
Bulletin of Postgraduate education: collection of scientific papers. Educational Sciences Series. Issue 34(63). Category «B»
https://doi.org/10.58442/3041-1831-2025-34(63)

теорією, комп'ютеризація має не лише сприяти розвитку особистості та творчих здібностей учнів, а й докорінно трансформувати всю освітню технологію. Впровадження інформаційно-комунікаційних технологій в освіту призводить до значної перебудови освітнього процесу та, як наслідок, до розробки відповідного методичного забезпечення використання комп'ютерних технологій на усіх рівнях освіти. Інформаційні технології, що використовуються у математиці, мають допомагати учням усебічно опанувати математичний апарат і прагнути застосовувати цей апарат до задач фізики та техніки. Сучасний етап цілеспрямованих та послідовних реформ в освіті Азербайджану ставить нові та вищі вимоги до вчителів щодо оволодіння сучасними методами та технологіями навчання, а також до їхньої загальної професійно-методичної підготовки. З метою підготовки вчителів, які відповідають цим вимогам, у вищих педагогічних закладах проводяться інтенсивні дослідження з удосконалення форм і методів організації навчання. Ці дослідження можна розділити на дві групи: перша стосується загальних проблем підготовки вчителів, а друга – питань, пов'язаних з підготовкою вчителів з конкретних предметів. Загалом, проведено низку досліджень, присвячених професійній підготовці вчителів, формуванню особистісних якостей у професійній діяльності, розвитку професійних та спеціальних навичок. Проблема підвищення якості викладання математичних дисциплін, що належать до групи фундаментальних предметів, часто обговорюється у сучасних методичних виданнях. Однак причини низького рівня знань студентів часто залишаються поза увагою; не визначаються предмети, курси та розділи, які погано засвоюються студентами, та не розробляються конкретні методики навчання для усунення цих недоліків. Тому розробка методик викладання предметів, курсів та розділів у межах курсів вважається однією з актуальних проблем. Все вищезазначене безпосередньо стосується курсу вищої математики, який вважається однією з фундаментальних математичних дисциплін у підготовці вчителів математики у вищих педагогічних закладах. Курс вищої математики займає важливе місце в навчальній програмі для майбутніх вчителів математики, оскільки він слугує основою для вивчення інших математичних дисциплін, дозволяє глибше зрозуміти та опанувати ці предмети та відіграє вирішальну роль у розвитку загального інтелектуального рівня та світогляду студентів. Вища математика, серед низки математичних дисциплін, вирізняється

операціями зі складнішими та багатограннішими поняттями та положеннями. За своєю природою вища математика допускає широкі узагальнення, виведення висновків та об'єднання різних досліджуваних процесів в єдину форму завдяки використанню системи універсальних методів і строгих математичних концепцій, що дозволяють моделювати різні процеси та їх застосування в різних галузях знань. Тому вдосконалення методологічної системи викладання цієї дисципліни є надзвичайно важливим. Водночас добре відомо, що в останні десятиліття обсяг інформації стрімко зростає. За таких обставин вивчення нових шляхів і засобів підвищення ефективності навчального процесу, спрямованого на покращення математичної підготовки майбутніх учителів математики, залишається важливим питанням, яке потребує вирішення.

Ключові слова: сучасна освіта; інформаційно-комунікаційні технології; викладання математики; вища математика; підготовка вчителів; педагогічні технології; математичне моделювання; методологічна система; ефективність навчального процесу.

REFERENCES (TRANSLATED AND TRANSLITERATED)

[1] A. S. Adygozalov, Theoretical Foundations of Teaching Mathematics in Schools. Baku, Azerbaijan : ASPU, 2018. [Online]. Available: http://web2.anl.az:81/read/page.php?bibid=590391&pno=1&lang=ru Application date: September 05, 2025. (in Azerbaijani).

[2] I. A. Gurbanov, A. I. Gurbanov, Mathematical Software Packages. Baku, Azerbaijan, 2005. [Online]. Available: https://adpuquba.edu.az/wp-content/uploads/2020/12/RIYAZI-PROQRAM-PAKETL%C6%8FRI.pdf Application date: September 05, 2025. (in Azerbaijani).

[3] A. Mekhrabov, A. Abbasov, Z. Zeynalov, R. Gasanov, Pedagogical Technologies. Baku, Azerbaijan, 2006. (in Azerbaijani).

[4] A. G. Palengov, M. V. Abdullaeva, Teaching Computer Science in Secondary Schools. Baku, Azerbaijan : Science and Education, 2015. [Online]. Available: http://web2.anl.az:81/read/page.php?bibid=vtls000693438 Application date: September 05, 2025. (in Azerbaijani).

[5] M. J. Makhmudov, Elements of Higher Algebra and Linear Algebra. Baku, Azerbaijan : AzTU, 2004. (in Azerbaijani).

[6] A. Kh. Pashayev, F. A. Rustamov, Pedagogy. New Course. Baku, Azerbaijan : Nurlan, 2007. (in Azerbaijani).

[7] F. A. Rustamov, T. Yu. Dadashova, Pedagogy of Higher Education. Baku, Azerbaijan : Nurlan, 2007. (in Azerbaijani).

[8] A. P. Rovai, L. D. Grooms, «The relationship of personality-based learning style preferences and learning among online graduate students», *Journal of Computing in Higher Education,* vol. 16, pp. 30–47, 2004. [Online]. Available: https://link.springer.com/article/10.1007/BF02960281 Application date: September 05, 2025. (in English).

[9] A. Santo-Sabato, M. Vernaleone, «From the First Generation of Distance Learning to Personal Learning Environments: An Overall Look», *E-Learning, E-Education, and Online Training*, № 138, pp. 155–158, 2014. https://doi.org/10.1007/978-3-319-13293-8_19 (in English).

[10] Tu. Chih-Hsiung, L. Sujo-Montes, Ch. -J. Yen, J. -Yi. Chan, M. Blocher, «The Integration of Personal Learning Environments & Open Network Learning Environments», *TechTrends*, vol. 56, is. 3, pp. 13–19, 2012. https://doi.org/10.1007/s11528-012-0571-7 (in English).

[11] G. R. Pik, «Students' Personality Types, Intended Majors, and College Expectations: Further Evidence Concerning Psychological and Sociological Interpretations of Holland's Theory», *Research in Higher Education*, vol. 47, is. 7, pp. 801–822, 2006. https://doi.org/10.1007/s11162-006-9016-5 (in English).

[12] G. Ritella, K. Hakkarainen, «Instrumental genesis in technology-mediated learning: From double stimulation to expansive knowledge practices», *International Journal of Computer-Supported Collaborative Learning*, vol. 7, is. 2, pp. 239–258, 2012. https://doi.org/10.1007/s11412-012-9144-1 (in English).

[13] H. I. Strømsø, I. Bråten, «The role of personal epistemology in the self-regulation of internet-based learning», *Metacognition and Learning*, vol. 5, is. 1, pp. 91–111, 2010. https://doi.org/10.1007/s11409-009-9043-7 (in English).

[14] *Knowledge management e e-learning in ambito sanitario* / M. Masoni, M. R. Guelfi, A. Conti, G. F. Gensini. Milan, Italy: Springer, 2011. (in Italian).

[15] M. Webb, «Pedagogy with information and communications technologies in transition», *Education and Information Technologies*, vol. 19, is. 2, pp. 275–294, 2012. https://doi.org/10.1007/s10639-012-9216-x (in English).

[16] A. M. Colman, *A Dictionary of Psychology*. Oxford University Press, 2009. [Online].
Available: https://www.researchgate.net/publication/280097882_A_Dictionary_of_Psychology Application date: September 05, 2025. (in English).

ISSN 3041-1831 (print) Ідентифікатор медіа: R30-05068
ISSN 3041-184X (online) *Media identifier: R30-05068*
Вісник післядипломної освіти: збірник наукових праць. Серія «Педагогічні науки». Вип. 34(63). Категорія «Б»
Bulletin of Postgraduate education: collection of scientific papers. Educational Sciences Series. Issue 34(63). Category «B»
https://doi.org/10.58442/3041-1831-2025-34(63)

[17] P. Sharma, S. Fiedler, «Supporting self-organized learning with personal Webpublishing technologies and practices», *Journal of Computing in Higher Education*, vol. 18, is. 2, pp. 3–24, 2007. https://doi.org/10.1007/BF03033411 (in English).
[18] R. L. Gilbert, J. A. Foss, N. A. Murphy, «Multiple Personality Order: Physical and Personality Characteristics of the Self, Primary Avatar and Alt», in *Reinventing Ourselves: Contemporary Concepts of Identity in Virtual Worlds.* London, England : Springer, 2011, pp. 213–234. https://doi.org/10.1007/978-0-85729-361-9_11 (in English).

Retrieved October 26 2025 отримано
Reviewed November 10, 2025 рецензовано
Published November 26, 2025 опубліковано