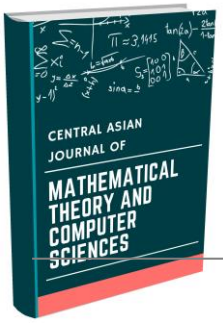

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DISTANCE LEARNING AS AN INNOVATIVE MODEL OF TEACHING MATHEMATICS

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Abstract

In the XXI century distance learning has become one of the most popular educational formats in higher education. The main driver of distance learning is the new needs of the labor market, requiring employees who are ready to adapt to changing conditions of the market and are included in the process of continuous self-improvement. Until now, the major part of the achievements of distance learning lay in the field of the humanities or special technical disciplines and was almost not integrated into the teaching of Mathematics in universities. We have developed and implemented a model of distance learning, adapted to the existing conditions for the teaching of mathematical disciplines in universities.

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In the XXI century, the role of distance education in the international practice of higher education has fundamentally transformed. From a method of education focused mainly on people with limited. With access to traditional educational formats, it has become one of the most popular and highly effective models used all over the world. Distance education is traditionally understood as the process of individual self-development of information, usually with the help of digital media, without the full-time presence of a teacher, who in this system becomes the coordinator of the educational process. Since the early 2000s, the principles of distance learning have been actively implemented in universities around the world. As B. Holmberg notes, In the 1980s, this format was most common in Australia, and by 2008, almost every university in the USA and most institutions of higher education in Europe offered such technologies [3]. The growing popularity of distance learning methods is due to the new requirements that the professional environment sets for novice specialists, as well as the rapid development of digital technologies in the educational field. In modern socio-cultural conditions, the labor market is in need of highly qualified employees involved in the process of continuing professional education and self-improvement, who have the ability to be independent, creative and adapt to the changing conditions of the professional environment. Thus, methods of work that stimulate independent activity of students acquire special importance in the practice of modern education. The trend of everything plays a significant role here greater inclusion in the educational process of the adult population over the age of 25, for whom education becomes a prerequisite for achieving success in a career.

In 2015, the International Council for Open and Distant Education (International Council for Open and Distant Education) conducted a survey in which 427 respondents who studied in Europe and on other

continents took part. The study showed that the main advantage of distance learning technologies for students from different countries, it is an opportunity to combine study with work – 32% of respondents indicated it [4].On the other hand, in order to remain competitive in modern social, economic and cultura l conditions, higher education institutions need to actively introduce innovations into the educational process, primarily based on digital technologies. V.S. Efimov and A.V. Lapteva note that "digitalization will be the main challenge for higher education in the period up to 2035 – the need for large-scale use of digital technologies in education and in the management of the university" [2]. Thus, the integration of distance learning technologies into the learning process will allow universities to be in line with international trends in the development of higher education. Modern distance education offers a variety of formats and technological tools, including: control,simulator, simulation and demonstration programs, automated training systems, hyper environments, multimedia and virtual reality programs, electronic textbooks, intelligent, expert training systems and much more. The most a common and proven option is the combination of the traditional full-time model and innovative approaches to distance learning. This paradigm provides for a flexible combination of independent work with various sources of information, educational materials and systematic operational interaction with leading teachers and consultants. It is based on the use of a wide range of traditional and new information technologies, as well as their technical means, which are used for delivery of educational material, its independent study, organization of dialogue exchange between the teacher and students.

In Russia and European, distance learning technologies have become widespread: a number of universities have distance education faculties, methodological advantages and problems of this format are outlined in dozens of works by Russian scientists. However, most of the research lies in the field of teaching humanities or special technical disciplines, to a lesser extent studied questions of the use of distance learning in teaching mathematics in higher education. At the same time, it is this discipline that is central to the fundamental training of students of a technical university and is studied in the first two courses. For many branches of knowledge, it is not only an instrument of quantitative calculation, but also a method of accurate research, a means of extremely clear formulation of concepts and problems. Without modern mathematics with its developed logical and computational apparatus, progress in various fields of human activity would be impossible. At the same time, the traditional method of teaching mathematics at the university does not contribute to the formation of students' motivation for continuous self-study and self-education, the ability to work creatively. In the learning process, the assimilation and memorization of ready made knowledge prevails, and so far independent work occupies an insufficient place.

Thus, the development of technologies and tools for distance education becomes especially relevant when studying mathematical disciplines. Based on these prerequisites, we have designed pedagogical conditions for the use of distance learning technology adapted to the existing conditions of teaching mathematical disciplines in higher education. The peculiarity of the conceptual model of teaching is the unity of three basic structural components: informational, psychological, pedagogical and cybernetic. The information component includes distance learning methods related to the content of the educational material,in this case, the accessibility of the material for the student audience, its novelty, rethinking of already known material, the formation of an individual educational trajectory, demonstration of the practical significance of the topic are important [1].

The psychological and pedagogical component is aimed at increasing creative activity, developing students' self-confidence, internal organization, ability to cooperate, orientation to success. It provides for active interaction with the teacher, analysis of test results, observations, conversations,questionnaires using mathematical data processing tools. Finally, the cybernetic component includes all possible methods and technical tools for obtaining, processing and storing information from information networks to virtual reality programs. The model implies a multi-level interaction between a student and a teacher. As part of the information component , it puts its goal is to create a complete and diverse didactic structure of the educational process with the help of specially designed textbooks and manuals. At the same time, the emphasis is on the student's independent work, while classroom classes play only an auxiliary role. At the level of the psychological and pedagogical component, there is constant communication between the teacher

and students,and its key goal is to increase the motivation of students to take initiative in the educational process. The cybernetic component implies the development by both the teaching staff and students of innovative learning technologies, including digital ones, interaction at the remote level with the use of modern means of communication. The constructed model reflects modern scientific approaches to the essence of distance learning and offers a new mechanism for reforming the system of teaching mathematical disciplines in higher education. This conceptual model was empirically tested during experiments conducted in the period from 2018 to 2021 at the Jizzakh state pedagogical university and as part of experimental research on the creation and improvement of teaching methods of higher mathematics. The objectives of this experimental work were to stimulate the intellectual activity of students, the formation of their ability to analyze and the comprehension of new information, original thoughts and the ability to make an informed choice of mathematical solutions. When organizing experiments, possible barriers to their implementation were taken into account.

The collective of any group of the university is extremely complex and diverse,and in order to ensure its normal functioning, the means, forms and methods of teaching should have no less diversity. The experiments were built on the principle based on the fact that none of the new forms of learning should displace the traditional ones, i.e. on a reasonable combination of the new with the old. The format of the work reflected all aspects of the conceptual model described above. It included the formation of students' psychological readiness to perceive new material, the development of skills to solve standard tasks, as well as the use of skills in solving non-standard tasks, while monitoring and communication with the teacher, as well as self-control at all stages were planned. During the experiments, two "variables" were taken into account: the specifics of the task and the characteristics of the student, i.e. the same task was proposed to solve different subjects and vice versa, the same subject was offered different tasks. The individual approach to the subjects consisted in the fact that the tasks were compiled not only according to different levels of complexity, but also according to various individual criteria.

The typical experiment consisted of three stages. At the first stage, students' psychological readiness to perceive new material and existing gaps were revealed. The goal of the stage was to eliminate these gaps in order to prepare for the next step. Then the students were it is proposed to get acquainted with new approaches in teaching mathematics, to conduct independent work with information materials in the "Theory review", "Help, control" mode. The result of this stage was the consolidation of new knowledge at the conceptual and structural level. The third stage involved the direct introduction of the information received into the educational process, the development of skills to solve the most typical tasks, independent work with a computer program in the "simulator" mode, the formation of understanding already at a standard-oriented level.

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