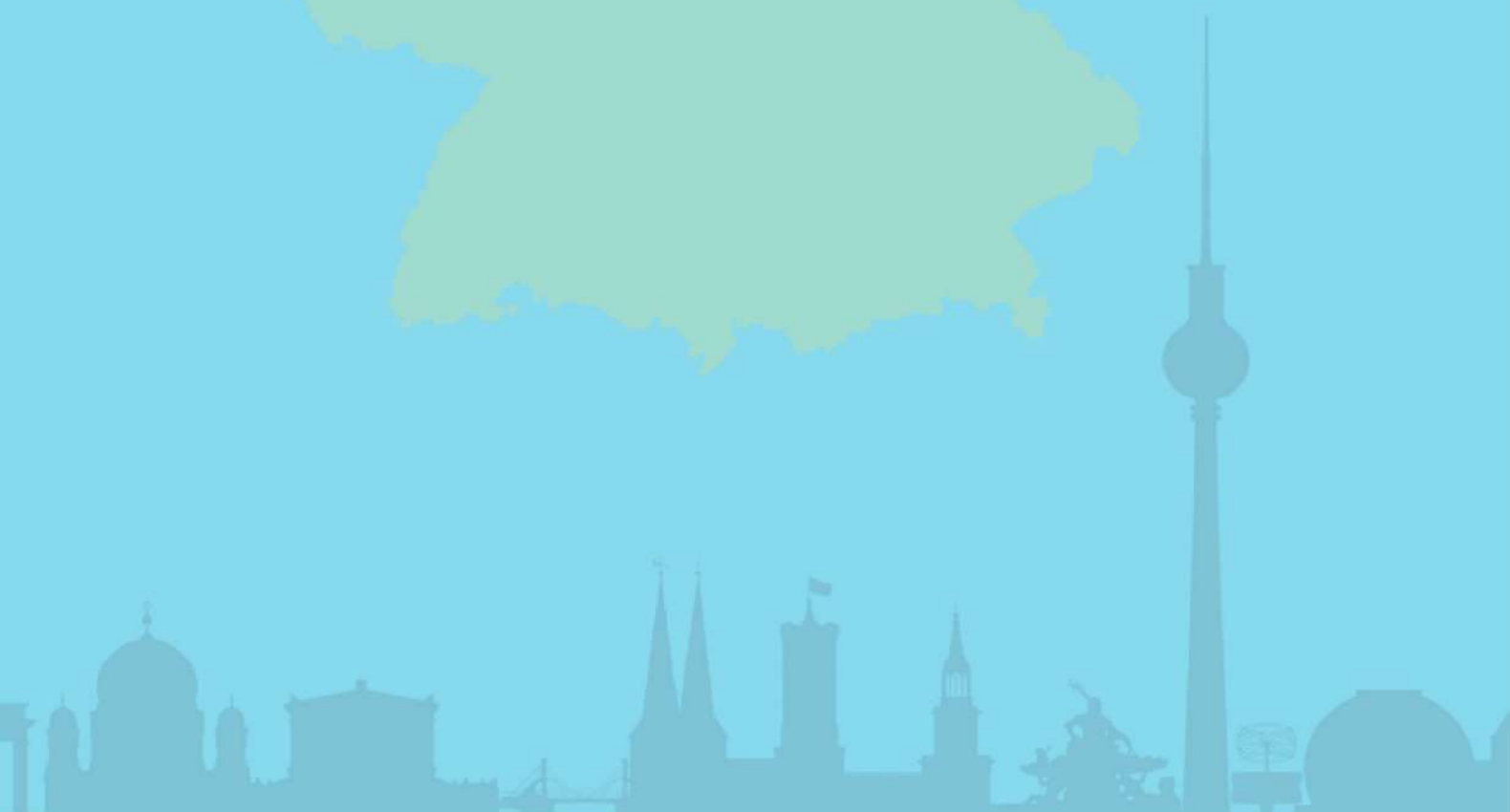




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METHODIK DER VERWENDUNG MODERNER INNOVATIVER TECHNOLOGIEN IN DER FERNBILDUNG

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Abstrakt: In diesem Beitrag diskutieren wir die Möglichkeiten des Einsatzes innovativer Technologien bei der Organisation des Fernlernprozesses an Hochschulen. Behandelt werden die Entstehungs- und Entwicklungsstadien der Form des Fernunterrichts und ihr aktueller Stand. Eine vergleichende Analyse der Forschungsergebnisse usbekischer und ausländischer Wissenschaftler zur effektiven Organisation von Fern- und traditionellem Unterricht. Zur Erleichterung des Lesers beschreibt der Artikel die Vorteile, Nachteile und Methoden der verwendeten innovativen Technologien „Unvollständiger Satz“, „Mikrofon“, „Tafel sauber“, „Mentaler Angriff“ und „Express-Tests“. Es sei darauf hingewiesen, dass solche innovativen Technologien darauf abzielen, das intellektuelle Denken von Schülern zu steigern, ihre Aktivität zu steigern und ihre kreative Aktivität im Bildungsprozess zu steigern. Am Beispiel einiger Themen des Faches „Diskrete Mathematik und mathematische Logik“ werden Inhalt und Wesen der an das Fernlernverfahren angepassten Fassung dieser Technologien erläutert. Es wurden methodische Empfehlungen entwickelt, um die Effizienz des Bildungsprozesses durch die Integration von Fernunterricht und traditionellen Unterrichtsformen zu steigern.

Schlüsselwörter: Fernunterricht, traditionelle Bildung, virtueller Unterricht, Innovation, Bildungstechnologien, „Unvollständiger Satz“, „Mikrofon“, „Sauberes Brett“, „Mentaler Angriff“-Methode, „Express-Tests“-Methode, experimenteller Prozess, Schülerkriterien, statistische Analyse, Experimentalgruppe, Kontrollgruppe, Diskrete Mathematik, Mathematische Logik.

METHODOLOGY OF USING MODERN INNOVATIVE TECHNOLOGIES IN THE DISTANCE EDUCATION

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Abstract: In this paper, we discuss the possibilities of using innovative technologies in the organization of the distance learning process in higher education institutions. The stages of emergence and development of the form of distance education and its current status are covered. A comparative analysis of the results of research conducted by Uzbek and foreign scientists on the effective organization of distance and traditional education. For the convenience of the reader, the article describes the advantages, disadvantages, and methods of “Incomplete sentence”, “Microphone”, “Clean board”, “Mental attack,” and “Express-tests” methods of innovative technologies used. It should be noted that such innovative technologies are aimed at increasing the

intellectual thinking of students, increasing their activity, and increasing their creative activity in the educational process. The content and essence of the version of these technologies adapted to the distance learning process are explained in the example of some topics of the subject “Discrete mathematics and mathematical logic.” Methodological recommendations have been developed to increase the efficiency of the educational process through the integration of distance and traditional forms of teaching.

Keywords: Distance education, traditional education, virtual lessons, innovation, educational technologies, “Incomplete sentence”, “Microphone,” “Clean board,” “Mental attack” method, “Express-tests” method, experimental process, student criteria, statistical analysis, experimental group, control group, discrete mathematics, mathematical logic.

1. Introduction

In the face of the global COVID-19 pandemic, new methods have been introduced in higher education due to the daily spread of coronavirus in almost all countries, as well as to limit the amount of face-to-face contact to prevent the spread of the virus. In particular, in Uzbekistan, since 2020-2021, due to the coronavirus pandemic, all educational institutions have launched virtual classes. In order to ensure the continuity of the educational process in the universities of the country and to provide methodological support for the level of distance learning of students, a distance learning platform has been developed.

It should be noted that the spread of coronavirus has stimulated the development of the education system and led to new innovations in education and led to surprisingly positive news. Of course, distance learning is not a new approach, but the pandemic situation in our country has led us to delve deeper into this methodology.

Distance education began to develop rapidly in the United States in the mid-1960s and in Europe in the early 1970s. This form of teaching is a goal-oriented interactive process of interaction between learners and teachers with each other and with teaching aids, without which the learning process does not depend on their geographical location. The educational process consists of sub-systems, i.e. a specific pedagogical system, which includes elements such as the purpose, content, methods, tools, organizational forms, control, educational-material, financial-economic, normative-legal and marketing.

The wide-ranging reforms in education in Uzbekistan today, in particular, government decisions on the development and improvement of mathematics science and education, link education to life, increase the effectiveness of teaching, nurture a harmoniously developed generation for a fast-growing society requires cultivation. In the traditional form of teaching, new pedagogical technologies have been widely used, which are the product of a specific goal-oriented form, method and means of education. But most of them are unique to the traditional form of learning process.

For completeness, we provide a brief overview of distance learning. Distance learning is a process of distance and interactive communication between students and teachers using the purpose, content, methods, teaching aids and Internet technologies of the educational process.

Distance education is a form of education based on the complex distance learning of all disciplines in the system of training specialists in a particular field, but not a conditionally established place and time criteria for the learning process within the complex.

Distance learning is the most important and increasingly popular form of modern education. Distance learning is a new modern form of teaching that develops the student's ability to think independently, assess the situation, and draw conclusions. Teachers independent learning, research, and thinking.

The introduction of distance learning provides for the following tasks: to achieve a significant increase in the number of students enrolled each year through the introduction of distance, e-learning and mixed education; organization of distance learning courses based on the implementation of accurate and comprehensive diagnostics, which allows to determine the abilities of students in certain areas; ensuring the quality of the tasks set for teaching students; introduction of information and communication and distance learning technologies; to increase the efficiency of the learning process through the integration of distance and traditional forms of teaching.

In this article, we will focus on the issue of increasing the efficiency of the learning process through the integration of distance and traditional forms of teaching. We are well aware that many pedagogical technologies can be used to organize the learning process in a traditional way. Most of them are based on interactive (innovative) interactions between teacher and student. This begs the natural question. Is it possible to apply pedagogical technologies to the distance learning process? If applicable, are they classified, i.e., divided into applicable and non-applicable types?

This article is devoted to the solution of these and similar topical problems. Several of the innovative methods have been adapted to the distance learning environment. They are described in detail in the example of effective teaching of the subject "Discrete Mathematics and Mathematical Logic" in higher education.

II. Literature review

A number of Uzbek and foreign scholars have conducted research on the effective organization of distance and traditional education. In this section, we will focus on some of them.

First, we analyze the research of Uzbek scientists in this area. The essence and theoretical foundations of innovative, modular, distance, computer, project, differentiated, individual, software and independent educational technologies in the work [1] and their types are described. It also describes the role and place of game technology in the educational process, the activation of students' learning activities,

increasing the effectiveness of teaching.

It is also argued that distance learning technologies are a set of forms, methods and tools aimed at ensuring that learning is carried out on the basis of a defined content. In [2] discussed issues such as trainings, open discussions, use of new pedagogical technologies in the organization of individual, pair, small group and team work in the process of teaching students. In particular, recommendations have been developed to improve the effectiveness of independent work of students on the basis of program knowledge, imagination and skills, to increase their activity during scientific thinking, theoretical and practical training.

Particular attention is paid to teaching students to work independently in the information-educational environment and to use information flow wisely. In [3] it was described the basic didactic concepts, models, principles of teaching distance learning, forms, methods of teaching, teaching aids, types of organization and control of the teaching process and other modern teaching methods. It was also noted that there is a need for the widespread introduction of distance learning technologies in conjunction with traditional forms of education.

In the book [4] the history of the problem of pedagogical technologies is studied and the theoretical characteristics of modern pedagogical technologies are given and the essence of modern teaching technologies illuminated.

A methodology for evaluating their effectiveness has been developed. In the work [5] there is information about the design of games from simulation, role-playing games, trainings and non-imitation technologies that activate the learning process, case studies, brainstorming, creative workshops, master classes, discussions and other technologies. Their uniqueness and features are shown.

Most of the interactive learning technologies of an interactive nature, including post-game discussions, and feedback, are listed. The requirements for the teacher conducting the game lesson and the requirements for the game are described.

In [6] it was described psychological and pedagogical developments aimed at changing traditional education, new ways of building the learning process, the technology of teacher work. According to him, "innovative learning" is the process and result of such educational and pedagogical activities that encourage the introduction of innovative changes in the existing culture, social environment.

In [7] it was discussed the current aspects of the introduction of distance learning technologies in higher education. These technologies have been shown to have significant uniqueness, allowing not only the transfer of full-time and part-time education in electronic form in higher education institutions, but also the more effective solution of traditional educational problems. Methodological, technical and technological features of the development of distance learning materials on the example of a distance course on the subject "Discrete Mathematics", developed on the basis of the modular information-educational environment Moodle.

In [8] it reveals the theoretical issues of distance learning, e-learning didactics,

the features of the organization of the educational process using distance learning technologies, taking into account the achievements of science, advanced educational practice and pedagogical experience. The practical section provides recommendations for the development and organization of distance learning courses using the Moodle distance learning system, a popular platform for creating a virtual learning environment.

In the book [9] the student is acquainted with the pedagogical technologies recommended for use in the system of distance learning, the specifics of their application in the distance learning process. In [10] it was explored the possibilities of distance learning as well as the problems of creating methodologically well-developed courses, and cites a number of ways to get acquainted with and improve the distance learning courses available in Russian and international scientific schools.

The book [11] provides a guide for education and training planners, senior education administrators, and teachers and trainers regarding the selection and use of modern technologies for open and flexible learning. It provides a practical decision-making framework, analyzing the strengths and weaknesses of each technology, and offering a comprehensive comparative cost analysis for each.

In the papers [12, 13, 14] the methods of using pedagogical technologies in the effective organization of mathematical classes are described.

III. Analysis.

Applications of some interactive methods.

Let's look at some interactive teaching methods.

1) "Incomplete sentence". (concept, definition, theorem, formula, etc.). The teacher points to an unfinished sentence. Students construct a short (2-3 sentences) to complete the idea.

2) "Microphone". The working principle of this technique is similar to that of "unfinished business". The student takes a "magic" microphone and is invited to finish the sentence. This method can be used effectively at the stage of stimulating (evaluating) learning activities, at the stage of learning a new topic and when generalizing.

3) "Clean board" method. In the "Knowledge Update" phase, the questions written on the board are discussed again, students answer them, and if there are correct answers, they are deleted from the board in turn. This method can be used in distance learning when the lesson is organized through ZOOM.

4) "Mental attack". Brainstorming is a very popular method of problem solving. This method is to collect a large number of ideas, to free students from the same inertia of thinking, to overcome the ideas that first appeared in the process of solving creative tasks. It encourages participants to use their imagination and creativity and helps them find numerous solutions to any given problem. This method is most often used on the site. <https://wheeldecide.com> on the site we fill the wheel with questions that can be used as an interactive method that can be used effectively in all lessons by setting time limits

and restrictions such as each student completing this task only once.

5) Examples of using “Express tests” in teaching the “Logic of predicates” section:

Test 1. Fill in the empty spaces with the most appropriate words: If only the negation, conjunction, disjunction (\neg, \wedge, \vee), and quantifiers (\forall, \exists) are involved in the expression of a predicate logic formula, and the negation operation belongs to elementary formulas (subject variables and variable predicates), then such a formula ... It is called ...

Answer: In an almost normal form.

Test 2. Choose the right word in parentheses and circle it: If the A formula is exactly true in any field, then it is A called (general value formula, exactly false formula).

Answer: A general formula.

Test 3. Circle the correct answer: $\forall x(P(x) \rightarrow R(x))$ - Which statement corresponds to this functional consideration?

A) All life is mortal.

B) Some people are hypocrites.

C) Not every number is divisible by 3.
a hill.

D) All cities are built on a river or

Answer: A).

Test 4. Choose the correct affirmation from below: The $\forall x [P(x) \vee \overline{P(x)}]$ formula is exactly true in M any field or The $\forall x [P(x) \wedge \overline{P(x)}]$ formula is exactly true in the M arbitrary field.

Answer: $\forall x [P(x) \vee \overline{P(x)}]$.

Test 5. Find the mistake in the sentence: It is necessary and A sufficient that there is no executable formula to be A general value formula.

Answer: It is necessary and \overline{A} sufficient that there is no executable formula for it to be A general value formula.

Test 6. Match the words with their logical pairs:

$\forall x \overline{A(x)}$, $\exists x \overline{A(x)}$, $\exists x A(x)$, $\forall x A(x)$, $\forall x \overline{A(x)}$, $\forall x A(x)$, $\exists x \overline{A(x)}$, $\exists x A(x)$.

Answer: 1. $\forall x \overline{A(x)} \equiv \overline{\exists x A(x)}$, 2. $\exists x \overline{A(x)} \equiv \overline{\forall x A(x)}$, 3. $\forall x A(x) \equiv \overline{\exists x \overline{A(x)}}$, 4. $\exists x A(x) \equiv \overline{\forall x \overline{A(x)}}$.

Test 7. Continue the sentence based on the definition of mathematical concepts and terms: Among the formulas of predicate logic in an almost normal form

Answer: Formulas in the normal form play an important role.

Test 8. Arrange the given formulas into pairs based on their mathematical concept properties:

1) $\overline{\exists x \forall z (P(x, y) \rightarrow P(y, z))}$; 2) $(p \rightarrow q) \wedge (\overline{r} \vee \overline{p})$; 3) $P(x) \wedge \forall x Q(x)$; 4) $\forall x (P(x) \rightarrow Q(x)) \leftrightarrow (\exists x P(x) \rightarrow \forall x R(x, y))$; 5) $(P(x) \leftrightarrow Q(x) \vee \exists y (\forall y R(y)))$; 6) $\exists x \forall z (P(x, y) \rightarrow P(y, z))$.

Answer: 1), 2), 4), 6) expressions are formulas, 3) and 5) expressions are not formulas. 1) in the formula it is a free variable, x and z if the variables are connected. 2) There are no subject variables in the formula. 4) A x variable bound in a formula is a z free variable.

Test 9. Find the appropriate interpretation of the terms given in column A from column B: Let the $P(x, y)$ predicate $M = N \times N$ be defined in the set and $P(x, y)$: « $x \geq y$ ».

In that case:

Answer:

$\forall x \forall y P(x, y)$	Exactly true
$\exists y \forall x P(x, y)$	Exactly false
$\exists y P(x, y)$	True
$\forall y P(x, y)$	False

$\forall x \forall y P(x, y)$	Exactly false
$\exists y \forall x P(x, y)$	True
$\exists y P(x, y)$	Exactly true
$\forall y P(x, y)$	False

It is recommended to use a wide range of effective methods of information coverage, including graphic diagrams and tables, in the design of teaching materials, lecture texts for distance learning. The following methods can be used to illustrate information on the basis of graphic schemes: “Graphic organizers” activate students' thinking, teach them to relate lesson topics and make independent observations about similarities and differences. Currently, the cluster, “Fish Skeleton”, “Cognitive Map”, “T-scheme-technique”, “Lily of the Valley”, “How?”, “Why?”, “Venn diagram” graphic organizers are widely used.

Also, the study of educational materials on the basis of openwork saw, boomerang, scarab, cascade, Veer, pinboard, dolphin, blitz-questionnaire, I.I.I. (I know, I want to know, I learned), conceptual table, insert table as well as easy to master.

IV. Discussion

The mechanism of carrying out experimental work. An adapted version of pedagogical technologies adapted to the distance learning process has been developed on the example of the subject “Discrete Mathematics and Mathematical Logic”.

In 2020-2021, “experimental” and “control” groups were formed among the students of “Mathematics” education of Bukhara State University, and experimental work was organized. For this, parallel groups with close levels of mastery were selected. The lessons in the control group were organized through a distance learning system and were conducted in a sequence based on the traditional approach: familiarization with the text of the lecture, completion and loading of the practical task, completion of the test.

In the experimental group, based on the proposed approach in the distance learning system: Lecture notes were enriched with graphics, tables, colors, interesting information using interactive methods, practical assignments was organized through various games, taken individually or in small group presentations and express-test was

carried out in the style of.

The criteria for evaluating the lesson in the control and experimental groups were the same and the following results were obtained:

Experience stage and academic year	Educational institution	Mastering level	At the beginning of the experiment		At the end of the experiment	
			In the Experimental Group	In the Control Group	In the Experimental Group	In the Control Group
2020 academic year	Bukhara State University	Higher (the best)	7 (20%)	6 (18%)	13 (37%)	9 (26%)
		High (good)	13(37%)	14(41%)	17 (49%)	15 (44%)
		Medium (satisfactory)	15(43%)	14(41%)	5 (14%)	10 (30%)

Table 1. Indicators of the formation of skills and abilities of students in the field of “Mathematics” using pedagogical technologies

Students in the group were considered to meet the requirements of state educational standards. In order to determine the effectiveness of distance learning on the basis of innovative technologies in the field of “Mathematics” on the basis of experiments, the final control questions received from students, the results of tests and generalization were analyzed in terms of quality and quantity.

Mathematical-statistical methods of pedagogical research methods were used in the analysis of experimental works. The following table shows the changes in the dynamics of students' knowledge (in terms of numbers and %) in the process of teaching based on innovative technologies.

At the beginning of the experiment:

$$\text{Experimental Group } T_{\text{quality}} = \frac{7+13}{35} = 57\%$$

$$\text{Control Group } T_{\text{quality}} = \frac{6+14}{34} = 59\%$$

At the end of the experiment:

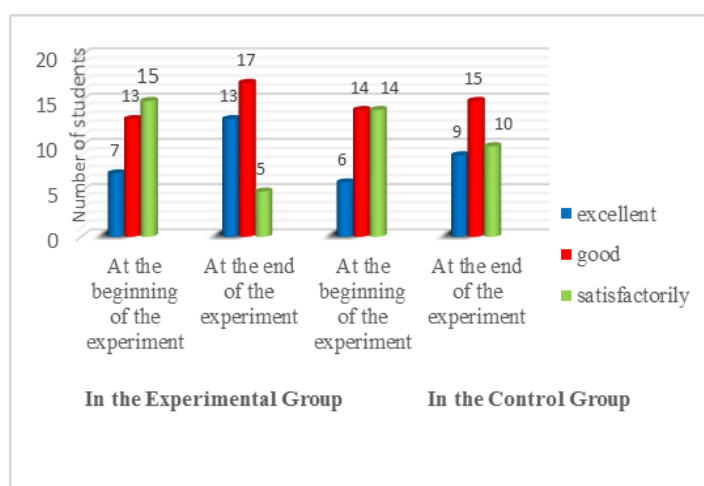
$$\text{Experimental Group } T_{\text{quality}} = \frac{13+17}{35} = 86\%$$

$$\text{Control Group } T_{\text{quality}} = \frac{9+15}{34} = 71\%$$

Experie	Educatio	Mastering	At the beginning of the	At the end of the
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nce stage and academi c year	nal Instituti on	Level	experiment		experiment	
			In the Experimental Group	In the Control Group	In the Experimenta l Group	In the Control Group
2020 academi c year	Bukhara State Universi ty	Mastery indicator	100%	100%	100%	100%
		Quality indicator	57%	59%	86%	71%
		Difference in quality indicator			+29%	+12%

Table 2. The changes of students' knowledge (%).



Picture 1. Histogram of experimental results

As can be seen from the histogram, when the subject “Discrete mathematics and mathematical logic” is taught remotely using pedagogical technologies, the quality indicators increased from 57% to 86% in the "experimental" group and from 59% to 71% in the “control” group.

V. Conclusion

In short, the essence of pedagogical technologies in distance learning is the interaction and integral activity of science teachers and students. Conclusions were made based on a comparison of the competence of students in the experimental group to work in distance learning, which showed an increase in the competence of students

in the course organized in distance learning using innovative methods in the control group compared to students studying through distance learning in the experimental group.

Application of pedagogical technologies in the process of distance learning in students

- initiative and independent thinking;
- Thorough mastering of knowledge;
- logical thinking;
- cultivate creative imagination allows the formation of such qualities as.

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