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Issue Article

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ANALYSIS AND EFFECTIVENESS OF EXPERIMENTAL WORK IN TEACHING METHODOLOGY OF "INFORMATION TECHNOLOGIES IN CONSTRUCTION" BASED ON MULTIMEDIA TOOLS

Abstract: *In this article, the stage of mathematical statistical analysis of the process of improving the method of teaching "Information technologies in construction" based on multimedia applications was carried out based on the Student-Fisher criteria. In the process of conducting experimental tests, teaching based on experience based on traditional teaching and multimedia applications was carried out at experimental sites of higher education, and the results were analyzed and its effectiveness was calculated. To calculate the results of the experimental work and to compare the mastery levels of the experimental and control groups, the average value of the students' grades, the mean square deviation and variances were used. From the above calculations, it can be seen that the performance of the experimental group increased by 13.86% compared to that of the control group [5]. From the results of the statistical analysis, it can be said that the test method used in the experimental groups is effective in the use of multimedia applications.*

Key words: *application, multimedia, methodology, efficiency, improvement, process, statistical analysis, Student-Fisher, criterion, experimental test, analysis.*

Language: *English*

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Introduction

In educational institutions of the world, creative technologies of informatization of educational processes, introduction of multimedia applications are being put into practice. In the new concept (in which concept) of education until 2030 adopted by

international organizations and developed countries [1], education is recognized as the main driving force of development and an important activity leading to the goals of sustainable development. In world and scientific research work, scientific research is being carried out on the provision of electronic resources of the intellectual sphere, on the production of information technologies on engineering and architect technologies, on the creation of Revit, AutoCAD, 3DSMax planning software tools on the computer. Extensive use of virtual educational technologies, electronic textbooks, multimedia electronic educational complexes in the educational process and provision of innovative knowledge to students in the fields of activity, continuous improvement of professional skills and qualifications, qualified in the process of managing the educational process using multimedia programs and modern production, special attention is paid to scientific research [5].

In recent years, our republic has rapidly developed the process of creating multimedia applications, e-textbooks intended for teaching on the basis of computer technologies, visual materials in technical higher education institutions, improving the content of creating multimedia applications and existing education. normative bases of teaching methodology and technologies are being created. Over the past years, comprehensive measures have been implemented to create a modern architectural image, accelerate construction in urban and rural settlements in our country, and effective mechanisms of state management have been introduced in the field of construction [2]. As a result, the pedagogical possibilities of future specialists in the field of architecture will be expanded by using computer technologies.

The data collection has been present in the segment of day education for centuries and preserves the historical tradition of the listener's learning. Against the background of these laws, by the end of the last century, the second side of the educational process began to manifest itself, and it is growing rapidly - as a result of the transfer of knowledge to people, to educational institutions, the educational process is transferred from classrooms to classrooms. led to the emergence of the possibility of remote organization outside, and this prompted the development of multimedia [12].

Multimedia competence of teachers, that is, literacy and multimedia communications, ensures technical and software compatibility in digitization of any information society [7].

To date, it is believed that we should pay special attention to the digital literacy of teachers in order to improve the teaching methods, not limited to the need to develop the digital competence of students [10]. "The teacher's ability to collect virtual technologies can be developed:

theoretical knowledge, modern information technologies and "resources of use". competence - the teacher's ability to use virtual technology. This definition indicates the necessary knowledge and professional-pedagogical skills in the work of a teacher. That is, the teacher's virtual technology competence is represented by the components designed to work with information corresponding to the systems. [6] Content, design and size of multimedia applications "Information technologies in construction" created for technical higher education institutions (150 points) by experts consisting of 10 specialists independent work and outside the educational process, evaluated in special scientific seminars. The average arithmetic of experts' evaluations of multimedia applications "Information technologies in construction" is expressed in the following table (table 1) [5].

Table 1. Results of evaluation of multimedia applications "Information technologies in construction".

№	Evaluation criteria	Maximum score	Average score according to the evaluation results
Content of multimedia applications (maximum score – 100 points)			
1.1.	Compliance of multimedia applications with State educational standards	10	9,8
1.2.	Compatibility of multimedia applications with an approved or existing curriculum	10	9,2
1.3.	Compatibility of topics in multimedia applications with the lesson time in the curriculum	10	9,8
1.4.	Ensuring the sequence and coherence of topics	10	9,2
1.5.	Embedding the ideas of national independence in the content of multimedia applications	10	8,4
1.6.	Scientifically correct presentation of materials when covering topics	10	9,2

1.7.	The modernity and interestingness of the method of presentation of educational materials in multimedia applications	10	9,2
1.8	Conformity of knowledge to the age and level of knowledge of students	10	8
1.9	Adequacy of exercises, tasks and practical exercises in lessons	10	9
1.10	Multimedia applications teach students to work independently on the subject	10	9,2
design and size of multimedia applications (maximum score - 50 points)			
2.1.	The number of illustrations, its adequacy to cover the lessons	10	9,2
2.2.	The quality of the illustrations, the attractiveness, the appropriate use of colors	10	9,2
2.3.	The combination of text and illustrations	10	9,4
2.4.	Stylistic consistency in the design and thematic placement of multimedia application materials (main title, topic title, illustrations, topic paragraphs, questions, exercises, practical exercises, etc.)	10	9,4
2.5.	The correct selection of fonts and the correct spacing between lines	10	9,4
	Total (points):	150	137,6

Based on the average arithmetic of the results of the evaluation of experts, the multimedia electronic textbook "Information Technologies in Construction" received a total maximum score of 137.6 points out of 150 (91.7% of the maximum score).

Now, in Samarkand State university of Architecture and Construction, Jizzakh Polytechnic Institute and Karshi Institute of Engineering and Economy undergraduate education areas, "Information Technologies in Construction", which have been designated as an experimental field, test the extent to which multimedia applications meet modern requirements for software creation and harmony of content, design and form of multimedia applications. we present the results. The results for software creation are presented in Table 2, and for the content, design and form of the e-textbook in Table 3 (the arithmetic mean of the evaluation results is included in the tables).

Table 2. Analysis of the main criteria for creating software

№	Criteria	Availability (+/-)	Quality level (in %) Sifat darajasi (% da)
1.	Student registration module	+	100%
2.	Ability to work in a computer class, on a local network	+	100%
3.	Administrator module	-	-
4.	Theoretical knowledge module	+	86%
5.	Practical knowledge module	+	84%
6.	Availability of test-control assignments	+	94%
7.	Availability of reference system	+	85%
8.	Information about the author	+	96%
9.	a guide to working with multimedia applications	+	95%
Average quality level:			82,2%

Table 3. Analysis of criteria for the harmony of the content, design and form of the electronic textbook

№	Criteria	Availability (+/-)	Quality level (in %)
1.	Texts	+	96%
2.	Photo illustrations	+	88%
3.	Animations	+	88%
4.	Laboratory work	+	72%
5.	Audio fragments	+	64%
6.	Video fragments	+	64%
7.	Issues	+	46%
8.	Dictionaries	+	88%
9.	Additional information	+	90%
Average quality level:			70,5%

It was found that on average, 82.2% of the electronic textbook meets the criteria for creating software, and 72.2% meets the criteria for the harmony of the content, design and form of the electronic textbook.

The multimedia electronic textbook "Information technologies in construction" can be used in the educational process of other technical higher education institutions of our republic.

The results of numerical data obtained from experimental work were analyzed, summarized and mathematical-statistical analysis was carried out in order to check its reliability. We will consider these calculations in the next stages of the work.

Analysis and effectiveness of pilot studies.

Before introducing electronic textbooks created on the basis of modern information technology tools to higher education institutions, it is necessary to determine the methods of its use and the level of efficiency. Because today, when the number of electronic textbooks is increasing rapidly, it is necessary to understand that it is suitable for the educational process and has practical value.

The multimedia textbook not only facilitates the student's learning, but also increases his interest in science, activates the learning process, and ensures the assimilation of new knowledge. Multimedia systems require a certain amount of technical tools and hardware, it may be necessary to use programs for editing photo fragments or multimedia programs, which in turn can take up a lot of computer memory and limit the workflow [9].

The use of multimedia resources is an important rule of theory and research, which is (perception), data, research and knowledge gathered from the environment[8].

The levels of students' mastery of science through electronic textbooks were determined by comparing the levels of learning from traditional textbooks. With the help of electronic textbooks, the deeper mastering of educational material, directing students to independent work on themselves and conducting creative research largely depends on its scientificity and method of use. A properly used e-textbook will help students to increase their knowledge and become competent specialists in their future professional activities.

Comparative research methodology was used in the study to achieve the research objectives.

The mathematical-statistical method was used to analyze the results of the pedagogical experiment. Experimental work was conducted in order to determine the level of effectiveness of the multimedia application in teaching "Information technologies in construction" in all undergraduate educational areas of Samarkand State university of Architecture and Construction in Samarkand, Jizzakh Polytechnic Institute in Jizzash, and Karshi Institute of Engineering and Economy in Karshi. In the course of the experiment, it became clear that e-textbooks not only provide information technology in construction, but also deep mastery of all subjects, easy solving of issues related to the topics in the process of traditional and distance education.

Forms of control are selected by departments according to the characteristics of a particular specialty and the scope of the educational process. In particular, colloquium or oral survey, laboratory work, software product, test forms are recommended.

Mathematical statistics methods were used to process the results of the experimental work. Experimental work was carried out to students of Samarkand State university of Architecture and Construction in Samarkand, Jizzakh Polytechnic Institute in Jizzash, and Karshi Institute of Engineering and Economy in Karshi in order to determine whether it is effective to adopt the subject "Information Technologies in Construction" as a basis for teaching on the basis of a multimedia application. went In order to calculate the results of the experimental work and compare the mastery levels of the experimental and control groups, the average value of the students' grades was calculated in the following table (see Table 4):

Table 4. The number of 1st-year students who participated in the experiment and their performance indicators

№	Semester	Grades obtained by students of the experimental and control groups									
		Experimental group					Control group				
		Total number of students	high	medium	low		Total number of students	high	medium	low	
Samarkand State Architecture and Construction university											
1	I	96	24	38	32	2	98	12	27	53	6
2	II	96	24	40	32	0	98	12	29	53	4
Average		96	24	39	32	1	98	12	28	53	5
Jizzakh Polytechnic Institute											
1	I	94	23	39	31	1	92	11	26	48	7
2	II	94	23	37	33	1	92	11	28	46	7
Average		94	23	38	32	1	92	11	27	47	7
Karshi Engineering Economics Institute											
1	I	84	23	33	26	2	86	11	28	40	7
2	II	84	23	35	24	2	86	11	30	40	5
Average		84	23	34	25	2	86	11	29	40	6
General		274	70	111	89	4	276	34	84	140	18

The general indicators of the control and experimental groups at the beginning of the experiment are as follows (see Table 5).

Table 5.

Groups (at the beginning of the experiment)	Number of students	Levels of mastery		
		High	Medium	Low
Experimental group	**272**	**30**	**81**	**163**
Control group	**274**	**29**	**82**	**165**

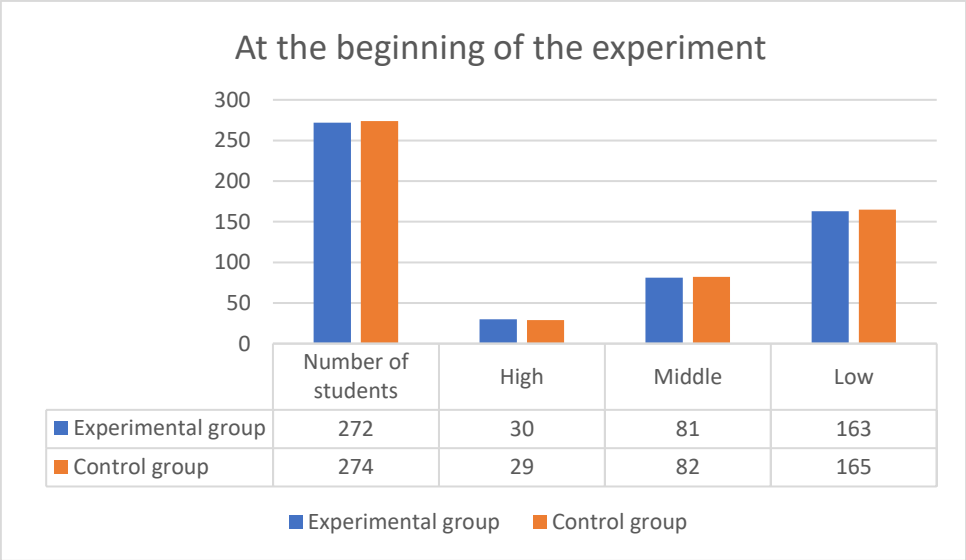

Figure 1. Learning dynamics of 1st year students.

The general indicators of the control and experimental groups at the end of the experiment are as follows (see Table 6).

Table 6.

Classes	**Number of students**	**Levels of mastery**		
		High	**Medium**	**Low**
Experience class	**272**	75	110	87
Control class	**274**	32	83	159

We will conduct a mathematical-statistical analysis of the received numerical data based on the Student-Fisher criterion.

We take the evaluation results in the experimental and control groups as the 1st and 2nd samples, respectively, and have the following variation series (see Table 7):

Table 7. Evaluation results in experimental and control groups

Selection 1					
Experimental group	X_i	**High**	**Medium**	**Low**	**Total number**
	n_i	75	110	87	n=272
Selection 2					
Control group	Y_j	**Excellent**	**Good**	**Satisfactory**	**Total number**
	m_i	32	83	159	m=274

We create the dynamics of acquisition in these selections (see Figure 2):

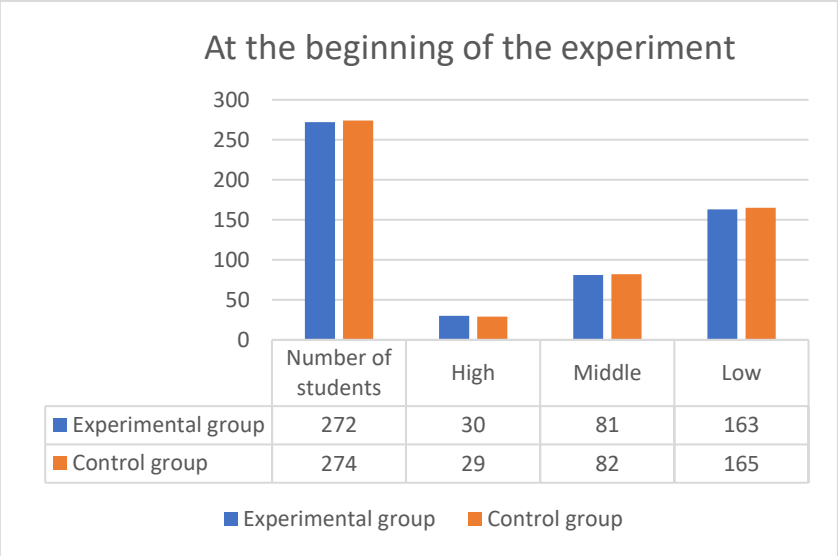

Figure 2. Learning dynamics of first-year students.

The graphs recorded in the figure show that the appropriate mean values for these samples also satisfy the conditions $\bar{X} > \bar{Y}$.

In order to calculate the results of the experimental work and compare the mastery levels of the experimental and control groups, the average value of the students' grades was calculated according to the following formula.

$$\bar{X} = \frac{1}{n}\sum_{i=1}^{4} n_i X_i$$

where x_i is the absorption index as a result of the control, and it takes values such as 3, 4, 5. the number of repetitions of grades received in the process of mastering. n_i is the number of students participating in experimental work.

Data were examined using descriptive statistics such as mean, standard deviation and regression analysis [11].

We calculate them based on the following formula:

$$\bar{X} = \frac{1}{n}\sum_{i=1}^{4} n_i X_i = \frac{1}{274}(75 \cdot 5 + 111 \cdot 4 + 88 \cdot 3) = \frac{1}{274}(375 + 444 + 264) = \frac{1083}{274} \approx 3{,}952$$

$$\bar{Y} = \frac{1}{m}\sum_{i=1}^{4} n_i Y_i = \frac{1}{276}(32 \cdot 5 + 84 \cdot 4 + 160 \cdot 3) = \frac{1}{276}(160 + 336 + 480) = \frac{976}{276} \approx 3{,}536$$

So, the average mastery in the experimental group is greater than in the control group: $\bar{X} > \bar{Y}$.

We calculate the coefficients of dispersion for both experimental and control groups. Based on this, we calculate the initial, sample variances [4]:

$$D_n = \sum_{i=1}^{4} \frac{n_i \cdot (x_i - \bar{X})^2}{n-1} = \frac{75(5-3{,}901)^2 + 111(4-3{,}901)^2 + 88(3-3{,}901)^2}{274-1} = \frac{75 \cdot 1{,}2 + 111 \cdot 0{,}009 + 88 \cdot 0{,}811}{273} = 0{,}594$$

$$D_m = \sum_{j=1}^{4} \frac{m_j(y_j - \bar{Y})^2}{m-1} = \frac{32(5-3{,}485)^2 + 84(4-3{,}485)^2 + 160(3-3{,}485)^2}{276-1} = \frac{32 \cdot 2{,}29 + 84 \cdot 0{,}27 + 160 \cdot 0{,}24}{275} = 0{,}482$$

From these results, we find the mean squared deviations:

$$\tau_n = \sqrt{0{,}594} \approx 0{,}771$$
$$\tau_m = \sqrt{0{,}482} \approx 0{,}694$$

Based on these, we calculate the variation indicators for both experimental and control groups:

$$\delta_n = \frac{\tau_n}{\bar{X}} = \frac{0{,}771}{3{,}952} = 0{,}1951$$

$$\delta_m = \frac{\tau_m}{\overline{Y}} = \frac{0{,}694}{3{,}536} = 0{,}1963$$

If we take the significance level of the statistical sign as $\alpha = 0{,}0012$, then the critical point for statistics from the Laplace function table is $t_{кн}$

$$\Phi(t_{кн}) = \frac{1-2\alpha}{2} = \frac{1-2\cdot 0{,}0238}{2} = 0{,}4988$$

The table for determining the critical point $t_{кн}$ for statistics from the Laplace function table is as follows (see Table 8).

Table 8.

$t_{кн}$	$\Phi(t_{кн})$	$t_{кн}$	$\Phi(t_{кн})$	$t_{кн}$	$\Phi(t_{кн})$	$t_{кн}$	$\Phi(t_{кн})$
0,00	0,000	0,33	0,1293	0,66	0,2454	0,99	0,3389
0,01	0,0040	0,34	0,1331	0,67	0,2486	1,00	0,3413
...	...	...	...	...	...	...	...
1,36	0,4131	1,67	0,4525	1,98	0,4761	**3**	**0,4987**

We determine from the equation: $t_{кн} = 3$ If we find reliable deviations from this estimate:

$$\Delta_n = t_{кн}\cdot\frac{D_n}{\sqrt{n}} = 3\cdot\frac{0{,}195}{\sqrt{274}} = 3\cdot\frac{0{,}195}{16{,}5} = 0{,}107$$

is equal to, and in the control group:

$$\Delta_m = t_{кн}\cdot\frac{D_m}{\sqrt{m}} = 3\cdot\frac{0{,}196}{\sqrt{276}} = 3\cdot\frac{0{,}196}{16{,}6} = \frac{1{,}24}{16{,}6} = 0{,}087$$

is equal to. If we find a confidence interval for the experimental class from the results found:

$$\overline{X} - t_{кн}\cdot\frac{D_n}{\sqrt{n}} \le \alpha_x \le \overline{X} + t_{кн}\cdot\frac{D_n}{\sqrt{n}}$$

$$3{,}952 - 0{,}107 \le \alpha_x \le 3{,}952 + 0{,}107$$

$$3{,}845 \le \alpha_x \le 4{,}060$$

Confidence interval for control class:

$$\overline{Y} - t_{кн}\cdot\frac{D_m}{\sqrt{m}} \le \alpha_y \le \overline{Y} + t_{кн}\cdot\frac{D_m}{\sqrt{m}}$$

$$3{,}536 - 0{,}087 \le \alpha_y \le 3{,}536 + 0{,}087$$

$$3{,}45 \le \alpha_y \le 3{,}63$$

Their geometric representation is as follows:

So, with a significance level of $\alpha = 0{,}0012$, it can be said that the average grade in the experimental group is higher than the average grade in the control group.

Based on the above results, we calculate the quality indicators of the experimental work. We know $\bar{X} \approx 3{,}952$ $\bar{Y} \approx 3{,}536$ $\delta_n \approx 0{,}594$ $\delta_m \approx 0{,}482$. From this, the teaching efficiency indicator is determined as follows:

$$K_{osb} = \frac{(\overline{X} - \delta_n)}{(\overline{Y} - \delta_m)} = 1{,}125 > 1$$

and we calculate the level of knowledge with the following formula:

$$K_{bdb} = (\overline{X} - \delta_n) - (\overline{Y} - \delta_m) \approx 0{,}47 > 0$$

From the obtained results, it can be seen that the evaluation criterion of teaching effectiveness is greater than 1, and the evaluation criterion of the level of knowledge is greater than 0. It is known that the performance of the experimental group is higher than that of the control group.

We calculate these mastery indicators in percentages:

$$\frac{\bar{X}}{3}\cdot 100\% - \frac{\bar{Y}}{3}\cdot 100\% = \frac{3{,}952 - 3{,}536}{3}\cdot 100\% = 0{,}1386\cdot 100\% = 13{,}86\%$$

Research results.

From the above calculations, it can be seen that the performance of the experimental group increased by 13.86% compared to that of the control group. So, it is clear from the results of the experiment that the students of the Samarkand State university of Architecture and Construction, the Jizzakh Polytechnic Institute in the city of Jizzash, and the Karshi Institute of Engineering Economics in the city of Karshi have achieved good results by teaching the subject "Information Technologies in Construction" on the basis of a multimedia application.

Based on the statistical analysis, it can be said that the test method of using multimedia applications used in the experimental groups is effective, and the test-test analysis provides a basis for its popularization on the scale of our republic.

Conclusions

When testing multimedia applications from the subject "Information technologies in construction" created for technical higher education institutions, it was taken into account to what extent it meets the following criteria: the presence of a student registration module; the possibility of working on a local network in a computer class; availability of the administrator module; availability of theoretical knowledge module; existence of practical knowledge module; availability of test control assignments; availability of reference system; availability of information about the authors; the existence of a manual on working with multimedia applications and the methods of organizing pedagogical experiments aimed at determining and evaluating the effectiveness

of multimedia applications "Information technologies in construction" were determined.

When evaluating the content, design and form of created multimedia applications, the following information was taken into account: texts, photo illustrations, animations, laboratory works, audio fragments, video fragments, problems, dictionaries, additional information were checked. . Mathematical statistical methods were used to determine the effectiveness of multimedia applications "Information technologies in construction". After conducting the experimental test using the traditional textbook and the electronic textbook, it was found that the results of the experimental group were higher than the control group, including that the average mastery score of the students increased from 56% to 90% in the 100-point system, good and the proportion of excellent students increased from 64.68% to 81.2%, the dispersion of scores compared to the average score decreased from 22% to 14%. The results of the test proved that the use of the created electronic textbooks in the educational process is effective.

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