# PEDAGOGICAL TECHNOLOGIES OF INCREASING THE EFFICIENCY OF GRAPHIC EDUCATION IN GENERAL SECONDARY SCHOOLS

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***Annotation:***

*Teachers of many secondary school subjects use graphical pictures, used in drafting. In the article the issue of pedagogical collaboration of a teacher of drafting with teachers of geometry, physics, chemistry, information, labor nurturing, which leads to progress in quality and efficiency of education – and level of pupils' graphical preparation. Also, the role and a place of the teacher plotting in providing a uniform graphic mode at school that promotes not only to development of graphic knowledge of pupils, but also increase quality and efficiency of the general education as a whole are characterized.*

***Key words:*** *graphical picture, graphical knowledge, theoretical base, competence, use, efficiency of graphical education, drafting, integration, educating process, improvement.*

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## INTRO .

The development of science, technology and technology in the developed countries of the world to a certain extent graphic education, especially technical improvement of drawing based on new approaches, increasing the quality and efficiency of education, pedagogical theory and teaching is gaining importance. Today, in a number of developed countries of the world, including the United States, Germany, China, Russia, Korea, Great Britain, Canada, India, Malaysia, Japan, etc., the development of students' spatial imagination, graphic knowledge, based on the practical application of educational technologies to the process of graphic education. It is reflected in the work aimed at increasing the effectiveness of the degrees, and developing theoretical knowledge and practical competencies in them .

Implementation of such didactic approaches as "integration of education", "technologicalization of education", "classification of image types", "interdisciplinary connection", "interdisciplinary integration", and "technology of providing a single graphic order" in the global field of graphic education in the optimal option based on pedagogical laws, general effective scientific and research work aimed at developing the graphic potential, scientific and creative abilities of secondary school students and increasing the effectiveness of graphic education is being carried out. The results of the research serve to form the necessary drawing competencies in students, reveal the essence of interdisciplinary connection, and strengthen the theoretical foundations of science teaching according to the integrative laws.

In the Strategy of Actions for further development of the Republic of Uzbekistan to improve the quality of general secondary education on the basis of defined tasks, to organize in-depth study of important and high-demand subjects, foreign languages, informatics, mathematics, physics, chemistry and biology, it is important to use an interdisciplinary approach and an integrative approach . This , in turn , didactic-illustrative materials used in the teaching of subjects such as mathematics, physics, geography, chemistry , various elements of drawing is an effective technological means of increasing students' mastery of the basics of general secondary education subjects. Therefore, it should be recognized as an actual pedagogical problem



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that providing a uniform graphic order in school is one of the factors of increasing the level of preparation of students in drawing and increasing the effectiveness of graphic education in general .

The analysis of the sources related to the research of graphic education problems shows that the scientific solutions to the problems related to various aspects of drawing are provided by the scientists of our country Sh.A. Abdurahmonov, T.D. Azimov, N.J. Yodgorov, K.A. Zoyirov, R.Q. Ismatullaev, P. ... .Umronkhojaev, A.K. Khamrokulov, Ch.T.Shokirova, Yu.Q. Kyrgyzboev, D.F. Kochkarova, H.R. Kuralova, N.I. Hurboevlar; Scientists of the Commonwealth of Independent States A.D. Botvinnikov, S.K. Bogolyubov, V.N. Vinogradov, A.A. Pavlova, N.G. Preobrazhenskoy, P.G. Satyanov, V.V. Stepakova, D.A . Thorzhevsky, N.F. Chetverukhin and foreign scientists: James D. Bethune, G.S Phull, H.S. Sandhu, R.B. Gupta, N.D. Bhatt are presented to some extent in the scientific and methodological works.

Also, Uzbek scientists B.S.Abdullaeva, K.T.Aldiyarov, S.T.Alikulov, A.G.Amirbekov, R.H.Djuraev, N.J.Isaqulova, M.Kh. Lutfillaev, I.V. Makukhina, A. Musurmonov, M.Q. Mukhliboev, B.N. Oripov, A.A. Salomov, N.I. Taylakov, N.S. Fayzullaeva, N.I. Hurboev; Scientists of the Commonwealth of Independent States M.N. Scientific research works were carried out by Berulava, V.S. Elagina, I.D. Zverev, V.N. Maksimova, N.G. Mikhaylov, L.G. Nartova, M.T. Rakhmatullin.

The graphic literacy of students is formed as a result of the integrative teaching of several subjects and the fact that these subjects are of particular importance in such educational fields as "Drawing", "Technology", "Mathematics", "Geography", "Physics" A.M. Umronkho'jaev, A.A. Pavlova, G.M.Tubaev, A.R.Rahimov, N.I.Hurboev, N.S. S.I. Dembinsky, V.I. Kuzmenko, the issue of introducing a single graphic mode in schools is partially theoretically based. However, it should be noted that in the works of the above scientists, the place of graphic preparation of students in the system of general education, and ways of using graphic knowledge based on an integrated approach were studied [2]. These ideas put forward in terms of pedagogical requirements of the 60s-70s of the XX century, firstly, based on new socio-pedagogical requirements, and secondly, on the basis of the concepts of increasing national educational efficiency, there remains a need for comprehensive research of this problem. At the same time, although the issues of increasing the effectiveness of graphic education with teaching in an environment where a single graphic order based on the integration of concrete and natural sciences is provided in the school, the issue of pedagogical technologies for increasing the effectiveness of graphic education has not been fully studied. That is why we want to recognize that the improvement of the pedagogical system of increasing the effectiveness of graphic education based on the development of the technology of providing a uniform graphic order in the teaching of academic subjects in the general secondary education system is an urgent pedagogical problem. After all, the factor of providing a uniform graphic order serves to increase the quality and effectiveness of education not only in drawing, but also in concrete and natural sciences, in particular, physics, mathematics, computer science, geography, chemistry, and technology.

Therefore, in this research work ng the technology of providing a unified graphic system based on the integration of concrete and natural sciences in improving the effectiveness of graphic education The goal was to check the efficiency.

**RESEARCH METHODS.**

In the research process, the Pearson method of mathematical-statistical processing and analysis of experimental results was used.

While researching the procedure for establishing and using interdisciplinarity in school education, N.S. Fayzullaeva paid special attention to the importance of "...synthesizing and summarizing the knowledge, skills and



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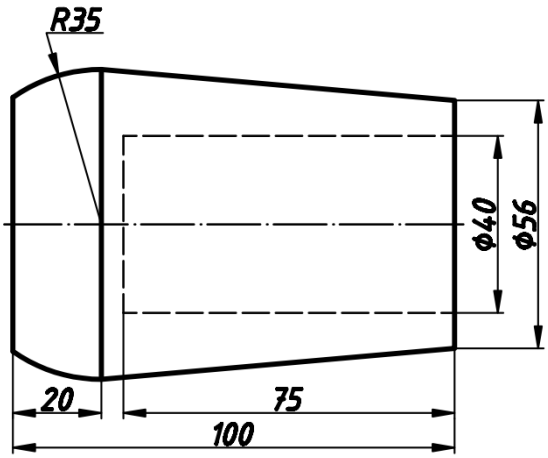
abilities acquired by students in the process of learning various subjects" and modern theoretical analyzes of the problem based on it, the use of opportunities for interdisciplinary communication draws attention to the fact that the theoretical and methodological foundations of systematization and generalization of students' knowledge are insufficiently developed" [1; 18-b]. The analysis of graphic materials in the content of graphic education organized on the basis of the laws of interdisciplinarity is the basis for determining the order of their appropriate use.

In order to ensure the reliability of the scientific research work, experimental tests were conducted. In accordance with the established procedure, a test program was developed and approved by the Scientific Council of UzPFITI.

In accordance with the program, in the 2017-2019 academic years, experimental work was carried out in schools of Namangan city 13-27, Jizzakh city 3-16, Shayhontokhur district 34-84 of Tashkent city . It was attended by 1092 students of 8-9 grades, 42 teachers of concrete and natural sciences.

For control work, everyone was given a drawing consisting of one projection of a wooden glass made of surfaces (the drawing was prepared by the teacher on the blackboard in advance. In some classes, the drawing made on a large paper was hung on the blackboard) ( Fig . 3.1 ) .




**3 . 1 - picture.**

During the one-hour lesson, the student had to copy the drawing on the board and draw a clear image of the item on the technical drawing. The main purpose of this work is to read the drawing and express the understanding of the shape of the object through a clear image.

The following was followed when students' work was evaluated. An "excellent" rating was given if the drawing was copied with attention to line types appropriate to its dimensions and the shape of the item was correctly represented in a clear image.

the visual image correctly describes the shape of the object, but the drawing is incomplete, or the visual image of the drawing is correctly started, but not completed.

A "satisfactory" grade was given if a drawing and a clear image were completed but both had deficiencies, or one was completely completed and the other had errors.

It is difficult to determine the degree of preference of a teaching method in a short period of time. The control task seemed a little more difficult for the students. Difficulties were observed in the students' work, especially during the performance of control tasks related to twisting and drawing the object.

the comparative analysis of the indicators of the results, 8 - A and 8 - B classes of the 3rd school of Jizzakh city were divided into the experimental group and 8 - A and 8 - B



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classes of the 16th school were divided into the control group.

When evaluating the completed work, if the projection and its dimensions provide sufficient information about the structure of the item, and the types of lines are used correctly, the work was given an "excellent" rating. If the shape of the item is fully reflected in the drawing, and there are errors in the line types, a "good" grade was given. "Satisfactory" was given if the shape of the object was completely understandable, but some lines remained, and "unsatisfactory" if the shape of the object was not correctly expressed.

Also, schools 1 3-2 7 in Namangan city , schools 3-16 in Jizzakh city Classes 9 -A and 9-B were divided into experimental and control groups according to the established procedure. Experience and control classes each from different schools is even better. Since the science teachers and drawing teachers are different , our experiment is more accurate, that is, the ideas in the teaching process in the experimental classes do not have an effect on the control classes. The number of students in the experimental and control classes is almost the same. 1 3rd school has 60 students in grades 9 - A and 9 - B, 2 7th school has 61 students in 9 - A and 9 - B grades. Pupils' grades in subjects are also approximately the same.

Table 16 shows the type of image used in the 9th grade science lesson and the percentage of the total number of images. In this table, which image types are common to which subjects (ie, used simultaneously in both that and this).

As far as we know, the teachers of the subjects listed in the table do not study drawing geometry and drawing during the student period. So, Taking into account the information in table 16 , one consultation-interview was organized for all teachers (except for the technology teacher) .

In the experimental classrooms, the science teachers paid attention to whichever type of images they used more, to ensure that these images were correctly executed and displayed in accordance with the rules of the state standard . For example, flat - planimetric images are mainly used in geometry classes. It was checked that they were made geometrically correctly on the board or in students' notebooks, and that they corresponded to the requirements of line types when running over the lines.

It was decided to test students' knowledge twice. The first is at the end of the 2nd quarter and the second is at the end of the 3rd quarter.

In the content of the problems given to test the students' knowledge, two projections of the object are given, which are copied with an approximate magnification of 1.5 times, the third position is found, and the necessary simple cuts are made and the dimensions are set. Such work is carried out in issues of options 1-2 . In the problems of option 3-4 , two projections of the detail are given. They are also copied in the same order, the third projection is found, and complex clipping is done and the dimensions are set. The criteria for selecting issues were as follows:

1. The terms of the problem should correspond to the topics covered in the first and second quarters of the 9th grade, that is, in all problems, views (projections) should be correctly described and dimensions (dimension lines) should be placed.

2. In the problems of the first and third options, simple frontal or profile and frontal and horizontal cuts are required.

3. In the problems of the second and fourth options, it is required to perform complex stepped or broken cuts.

In order to expand the experimental area, experimental tests were conducted in the 8 - V , G and 9 - V , G classes of the 34th school in the Shayhontokhur district of Tashkent city, and in the 9-A and B classes of the 84th school .

From these , 8 -V and 9-V classes of school 34 , 9-A class of 84 school were separated into the experimental class , 8 -G and 9-G classes of 34 school and 9-B class of 84 school were separated into the control class . .



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In these classes the number of students is almost the same .

As before, the teachers of algebra, geometry, chemistry, geography, physics, informatics and technology were gathered and interviewed. The first conversation was general. Our last interviews were conducted according to the 8-hour special course specified in § 2.2 . Through such conversations, science teachers were given information about the basic concepts of drawing and the rules of the state standard.

Science teachers were interested in learning the rules of the standard by asking the drawing teacher. Some of them tried to find out about their interests by applying individually. The drawing teacher told the students what information might be needed in which subjects during his lessons.

of the 8th grade drawing course , drawing rules, fonts, geometric constructions, connecting elements, inclined and conic, connecting figures, ovals and ellipses are studied. Therefore, at the end of the second quarter, in order to test the students' level of knowledge, it was decided to assign the task of drawing an oval and an ellipse on two diameters (axes) AB and CD.

Tasks consisted of two options:

Option 1 . Major axis AV = 100mm. Make an oval curve with minor axis CD=60mm.

Option 2 . Major axis AV = 100mm. Make an ellipse curve with minor axis CD=60mm.

8 -V experimental and 8 -G control classes all students performed the control task in general to varying degrees.

Positive grades in the experimental classes were 85%, and 72% in the control classes. There is a difference anyway. There are more things done right in practice classes and it's also right to be enthroned. That is, attention is paid to line types and fonts. In the control class, there are also works done correctly, but although the construction is correct , in some of them the auxiliary lines are also bold, oval and ellipse lines, which should be bold, are not bolded in all of them.



in the 9th grades, control work with the same content was conducted in the experimental and control classes. Options given to the 13th, 27th, and 9th grades of Namangan city schools were used for control work . In this case, 4 options were selected. Their content is as follows. In the problems of options 1-2 , the given two projections of the detail should be sketched, copied and enlarged approximately 1.5 times, and the third projection should be found, and the necessary simple cuts should be made in the projections and their dimensions should be set. In options 3-4 , the given two projections of the detail should be copied in the same way and a third projection should be made, and one with a complex step, the other with a broken cut and the size lines should have been placed.

In the task of the first option, a simple cut should be given in frontal and profile projections. In the second option, a simple cut is depicted in frontal and horizontal projections. In the case of the third variant, complex step shear and in the fourth variant, complex fracture shear should be represented. (In order to facilitate the work, it is better to choose the dimensions of the details in the form of a sketch).

9th grade , the science teachers reminded the students of the rules of drawing and drawing when appropriate during the lesson. This is probably why more correct work was counted in these classes than in the control classes. This time, the results of the experiment and test showed that it is possible to increase the level of graphic preparation of students by providing a uniform graphic order (mode) in the school.



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experimental testing of 8-9 grade students of general secondary schools the number of participating students and their indicators are presented in tables 3.1 and 3.4.

***Table 3.1***

**8th grade students who took part in the experiment and their performance indicators**

| No | A quarter | Experience class | | | | Control class | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Total number of students | High | Medium | Low | Total number of students | High | Medium | Low |
| **34 in Tashkent 84 general secondary schools** | | | | | | | | | |
| 1 | I | 87 | 39 | 41 | 7 | 88 | 24 | 38 | 26 |
| 2 | II | 89 | 35 | 43 | 11 | 90 | 21 | 42 | 27 |
| 3 | III | 89 | 37 | 44 | 8 | 90 | 25 | 35 | 30 |
| 4 | IV | 87 | 36 | 42 | 9 | 88 | 23 | 40 | 25 |
| **13 in Namangan region, 27 general secondary schools** | | | | | | | | | |
| 1 | I | 92 | 32 | 49 | 11 | 88 | 20 | 39 | 29 |
| 2 | II | 88 | 27 | 54 | 7 | 92 | 19 | 44 | 29 |
| 3 | III | 92 | 34 | 49 | 9 | 88 | 18 | 43 | 27 |
| 4 | IV | 88 | 27 | 52 | 9 | 92 | 21 | 41 | 30 |
| **3 in Jizzakh region, 16 general secondary schools** | | | | | | | | | |
| 1 | I | 89 | 33 | 48 | 8 | 92 | 20 | 44 | 28 |
| 2 | II | 88 | 40 | 43 | 5 | 86 | 18 | 41 | 27 |
| 3 | III | 90 | 35 | 48 | 7 | 90 | 23 | 39 | 28 |
| 4 | IV | 92 | 32 | 51 | 9 | 88 | 20 | 40 | 28 |
| General average I | | 89 | 35 | 46 | 8 | 89 | 21 | 40 | 28 |
| General average II | | 88 | 34 | 47 | 8 | 89 | 20 | 42 | 28 |
| General average III | | 90 | 35 | 47 | 8 | 89 | 22 | 39 | 28 |
| General average IV | | 89 | 32 | 48 | 9 | 89 | 21 | 40 | 28 |
| **Overall average** | | 89 | 34 | 47 | 8 | 89 | 21 | 40 | 28 |

We will conduct a mathematical-statistical analysis of the received numerical data based on the Student and Pearson criteria.

From the table above, we obtained the general average for mathematical-statistical analysis. The general indicators of the control and experimental groups at the end of the experiment are presented in Table 3.2.



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***Table 3.2***

**Overall performance of the control and experimental groups at the end of the experiment**

| Groups | Number of students | Answers | | |
|---|---|---|---|---|
| | | High | Medium | Low |
| Experimental group | 89 | 34 | 47 | 8 |
| Control group | 89 | 21 | 40 | 28 |

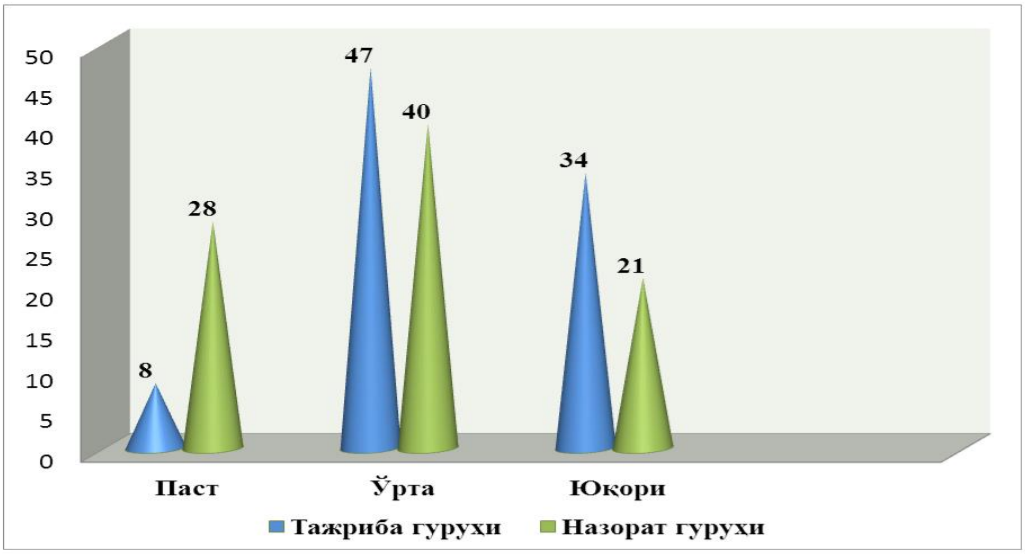


If we take the results of the assessment in the experimental and control group as samples 1 and 2, respectively, we have the following variation series (Table 3.3):

***3. Table 3***

| Selection 1 | | | | | |
|---|---|---|---|---|---|
| **Experimental group** | **$X_i$** | **High** | **Medium** | **Low** | **General average number** |
| | $n_i$ | 34 | 47 | 8 | No. =89 |
| **Selection 2** | | | | | |
| **Control group** | $Y_j$ | **High** | **Medium** | **Low** | **General average number** |
| | $m_j$ | 21 | 40 | 28 | m =89 |

This is consistent with the selections we create diagrams ( Fig. 3.8 ) :




**RESULTS.**

From the plot recorded on the polygon, also the appropriate mean values for the samples $\overline{X} > \overline{Y}$ presupposes the satisfaction of the conditions. We calculate them based on the following formula:

$$\overline{X} = \frac{1}{n}\sum_{i=1}^{3} n_i X_i = \frac{1}{89}(34\cdot 5 + 47\cdot 4 + 8\cdot 3) = \frac{1}{89}(170 + 188 + 24) = \frac{382}{89} = 4{,}2921 \approx 4{,}3$$

$$\overline{Y} = \frac{1}{m}\sum_{j=1}^{3} n_j Y_j = \frac{1}{89}(21\cdot 5 + 40\cdot 4 + 28\cdot 3) = \frac{1}{89}(105 + 160 + 84) = \frac{349}{89} = 3{,}9213 \approx 3{,}9$$

Therefore, the average mastery in the experimental group is higher than in the control group: $\overline{X} > \overline{Y}$.

In percent



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$$\frac{\bar{X}}{3}\cdot 100\% - \frac{\bar{Y}}{3}\cdot 100\% = \frac{4{,}2921}{3}\cdot 100 - \frac{3{,}9213}{3}\cdot 100 = \frac{37{,}08}{3} = 12{,}36\,\%$$

Growth – $\bar{X}\% - \bar{Y}\% = 12{,}36\%$

So , experience is a test works at the end Knowledge of 8th grade students indicators medium in the account to 12 , 36 % increased _ 

We calculate the dispersion coefficients for both groups. To this end, we first calculate the sample variances:

$$D_n = \sum_{i=1}^{3} \frac{n_i (x_i - \bar{X})^2}{n-1} = \frac{34(5-4{,}3)^2 + 47(4-4{,}3)^2 + 8(3-4{,}3)^2}{88} =$$

$$\frac{34\cdot 0{,}49 + 47\cdot 0{,}09 + 8\cdot 1{,}69}{88} \approx \frac{16{,}66 + 4{,}23 + 13{,}52}{88} = \frac{34{,}41}{88} \approx 0{,}39$$

$$D_m = \sum_{j=1}^{3} \frac{n_j (y_j - \bar{Y})^2}{n-1} = \frac{21(5-3{,}9)^2 + 40(4-3{,}9)^2 + 28(3-3{,}9)^2}{88} =$$

$$\frac{21\cdot 1{,}21 + 40\cdot 0{,}01 + 28\cdot 0{,}81}{88} \approx \frac{25{,}41 + 0{,}4 + 22{,}68}{88} = \frac{48{,}49}{88} \approx 0{,}55$$

From these results we find the mean squared deviations :

$$\tau_n = \sqrt{0{,}39} \approx 0{,}62; \qquad \tau_m = \sqrt{0{,}55} \approx 0{,}74;$$

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

$$\delta_n = \frac{\tau_n}{X} = \frac{0{,}62}{4{,}3} \approx 0{,}14; \quad \delta_m = \frac{\tau_m}{Y} = \frac{0{,}74}{3{,}9} \approx 0{,}19;$$

Now we each two statistics selections theoretical medium values equality about $H_0$ : $a_X = a_Y$ the hypothesis Student criterion using we will check . That's it for the purpose of statistics we calculate :

$$T_{n,m} = \frac{\left|\bar{X} - \bar{Y}\right|}{\sqrt{\frac{S_X^2}{n} + \frac{S_Y^2}{m}}} = \frac{|4{,}29 - 3{,}92|}{\sqrt{\frac{0{,}39}{89} + \frac{0{,}55}{89}}} = \frac{0{,}37}{0{,}10} = 3{,}7$$

Student 95% of the criterion critical point $t_{kp}(0.95) = 1{,}96$ of statistics _ value from him enough is large : $T_{n,m} = 3{,}7 > 1.96 = t_{kp}(0.95)$

So , we $H_0$ the hypothesis refuse reached _ $\bar{Y} > \bar{X}$ and $a_x > a_y$ relationships attention received without , that is experience from work then , always average appropriation indicator previous appropriation from the indicator big will be he said _ conclusion do it we can Based on the Student's criterion, we calculate the degree of freedom using the following formula:

$$K = \frac{\left(\frac{S_x^2}{n} + \frac{S_y^2}{m}\right)^2}{\frac{\left(\frac{S_x^2}{n}\right)^2}{n-1} + \frac{\left(\frac{S_y^2}{m}\right)^2}{m-1}} = \frac{\left(\frac{0{,}39}{89} + \frac{0{,}55}{89}\right)^2}{\frac{\left(\frac{0{,}39}{89}\right)^2}{88} + \frac{\left(\frac{0{,}55}{89}\right)^2}{88}} = 171{,}04$$



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for this probability the value level of a statistical sign

$\alpha$ =If we take 0.05 , then *r* =1- $\alpha$=0.95 and degrees of freedom

*k* =171.04 is equal to The critical point of the binomial criterion from the Student's function distribution table:

$$t_{1-\frac{(1-p)}{2}}(k) = t_{1-\frac{(1-0,95)}{2}}(171,04) = t_{0,975}(171,04) = 1,96$$



Finally , we $X_i$ and $Y_i$ statistics of selections distribution laws equality about $K: F_x = F_y$ the hypothesis check for Pearson ( chi-square ) criterion we use

$$\chi^2 = \frac{1}{N \cdot M} \cdot \sum_{i=1}^{k} \frac{(n_i M - m_i N)^2}{n_i + m_i}.$$

This on purpose the following the table make up we get :

***3. Table 4***

| Grades / Guru xlar | 5 | 4 | 3 |
|---|---|---|---|
| Experience - from testing after | 34 | 47 | 8 |
| Experience - from testing before | 21 | 40 | 28 |

Pearson statistics we calculate ( n = m =89) :

$$\chi^2 = \left( \frac{(34-21)^2}{34+21} + \frac{(47-40)^2}{47+40} + \frac{(8-28)^2}{8+28} \right) = 14,74$$

Pearson of the criterion freedom level points number to 1 is less : k =3 -1 =2 , this k =2 to corresponding to 95 % critical point $Z_{kp}(0,95) = 5,99$.

Therefore, the statistical analysis conducted on the results of the research and presented in the dissertation shows that the experimental work is effective and our intended goal is confirmed.

But , $\chi^2 = 14,74 > 5,99 = Z_{k,p}(0,95)$

So , K hypothesis too refuse meat it is This and experience is a test from work previous and next teaching of methodologies differentiation random not but _ legal always _ _ appropriation indicators to increase take will come it is

If we take the significance level of the statistical sign as 0.05, $\alpha$=then the critical point for statistics from the Laplace function table is $t_{kn}$

$$\Phi(t_{kн}) = \frac{1-2\alpha}{2} = \frac{1-2 \cdot 0,05}{2} = \frac{0,9}{2} = 0,45$$

equation: $t_{kн} = 1,65$. From this, we find the reliable deviations of the experimental group estimates:

$$\Delta_n = t_{kн} \cdot \frac{D_n}{\sqrt{n}} = 1,65 \cdot \frac{0,39}{\sqrt{89}} = \frac{0,64}{9,4} \approx 0,07$$

equal to, and that of the control group:

$$\Delta_m = t_{kн} \cdot \frac{D_m}{\sqrt{m}} = 1,65 \cdot \frac{0,55}{\sqrt{89}} = \frac{0,9075}{9,4} \approx 0,1$$

to equal to



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From the results experimental and control group for Reliable based on the idea of Neiman intervals found :

If we find a confidence interval for the experimental group from the results found:

$$\overline{X} - t_{kн} \cdot \frac{D_n}{\sqrt{n}} \le a_x \le \overline{X} + t_{kн} \cdot \frac{D_n}{\sqrt{n}}$$

$$4{,}3 - 0{,}07 \le a_x \le 4{,}3 + 0{,}07$$

$$4{,}23 \le a_x \le 4{,}37$$

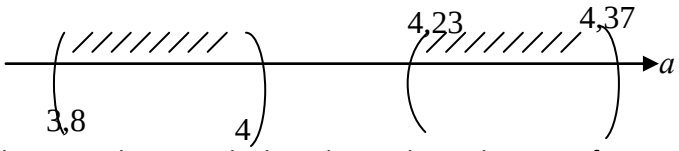


Confidence interval for the control group:

$$\overline{Y} - t_{kн} \cdot \frac{D_m}{\sqrt{m}} \le a_y \le \overline{Y} + t_{kн} \cdot \frac{D_m}{\sqrt{m}}$$

$$3{,}9 - 0{,}1 \le a_x \le 3{,}9 + 0{,}1 \qquad 3{,}8 \le a_x \le 4$$

Their geometric representation is as follows:




Based on the above results, we calculate the quality indicators of experimental work.

We know $\overline{X}$ =4.3; $\overline{Y}$ =3.9; $\delta_n = 0{,}14$; $\delta_m = 0{,}19$ is equal to

From this, the teaching effectiveness indicator is determined as follows:

$$K_{усб} = \frac{(\overline{X} - \delta_n)}{(\overline{Y} + \delta_m)} = \frac{4{,}3 - 0{,}14}{3{,}9 + 0{,}19} = \frac{4{,}16}{4{,}09} = 1{,}02 > 1;$$

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

$$K_{бдб} = (\overline{X} - \delta_n) - (\overline{Y} - \delta_m) = (4{,}3 - 0{,}14) - (3{,}9 - 0{,}19) = 4{,}16 - 3{,}71 = 0{,}45 > 0.$$

From the obtained results, the evaluation criterion of teaching efficiency is greater than one *($K_{usb}$ =1.02>1)* and the evaluation criterion of knowledge level is greater than zero *($K_{bdb}$ =0.45>0)* . can be seen. It is known that the performance of the experimental group is higher than that of the control group.

- statistical analysis for 9th graders as well. The number of students who participated in the experiment and their indicators are presented in Table 3.5.

***Table 3.5***

**9th grade students for the experiment and their achievement indicators**

| No | A quarter | Experience class | | | | Control class | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Total number of students | High | Medium | Low | Total number of students | High | Medium | Low |
| **34th, 84th secondary schools in Tashkent** | | | | | | | | | |
| 1 | I | 87 | 37 | 42 | 8 | 88 | 26 | 37 | 25 |
| 2 | II | 88 | 36 | 41 | 11 | 89 | 22 | 41 | 26 |
| 3 | III | 89 | 37 | 45 | 7 | 90 | 26 | 36 | 28 |



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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 4 | IV | 88 | 35 | 43 | 10 | 87 | 22 | 39 | 26 |
| **13th and 27th general secondary schools in Namangan region** | | | | | | | | | |
| 1 | I | 91 | 32 | 49 | 10 | 90 | 21 | 40 | 29 |
| 2 | II | 89 | 29 | 52 | 8 | 90 | 20 | 42 | 28 |
| 3 | III | 89 | 33 | 45 | 11 | 88 | 18 | 43 | 27 |
| 4 | IV | 90 | 28 | 53 | 9 | 91 | 22 | 40 | 29 |
| **3rd, 16th general secondary schools in Jizzakh region** | | | | | | | | | |
| 1 | I | 91 | 34 | 47 | 10 | 92 | 20 | 44 | 28 |
| 2 | II | 91 | 41 | 42 | 8 | 89 | 21 | 42 | 26 |
| 3 | III | 90 | 34 | 44 | 12 | 91 | 22 | 42 | 27 |
| 4 | IV | 91 | 30 | 50 | 11 | 91 | 23 | 44 | 24 |
| General average I | | 89 | 34 | 46 | 9 | 90 | 22 | 40 | 27 |
| General average II | | 89 | 35 | 45 | 9 | 89 | 21 | 42 | 27 |
| General average III | | 89 | 35 | 45 | 10 | 90 | 22 | 41 | 27 |
| General average IV | | 90 | 31 | 49 | 10 | 90 | 22 | 41 | 26 |
| **Overall average** | | 89 | 34 | 46 | 10 | 89 | 22 | 41 | 27 |



We will conduct a mathematical-statistical analysis of the received numerical data based on the Student and Pearson criteria.

From the table above, we obtained the general average for mathematical-statistical analysis. The general indicators of the control and experimental groups at the end of the experiment are presented in Table 3.6.

***Table 3.6***

**Overall performance of the control and experimental groups at the end of the experiment**

| Groups | Number of students | Answers | | |
|---|---|---|---|---|
| | | High | Medium | Low |
| Experimental group | 90 | 34 | 46 | 10 |
| Control group | 90 | 22 | 41 | 2 7 |

If we take the results of the assessment in the experimental and control group as samples 1 and 2, respectively, we have the following variation series (Table 3.7):



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***Table 3.7***

| Selection 1 | | | | | |
|---|---|---|---|---|---|
| **Experimental group** | **$X_i$** | **High** | **Medium** | **Low** | **Total number** |
| | $n_i$ | 34 | 46 | 10 | No. =90 |
| **2 - selection** | | | | | |
| **Control group** | $Y_j$ | **High** | **Medium** | **Low** | **Total number** |
| | $m_j$ | 22 | 4 1 | 2 7 | m =90 |

This is consistent with the selections we create diagrams ( Fig. 3.9 ) :

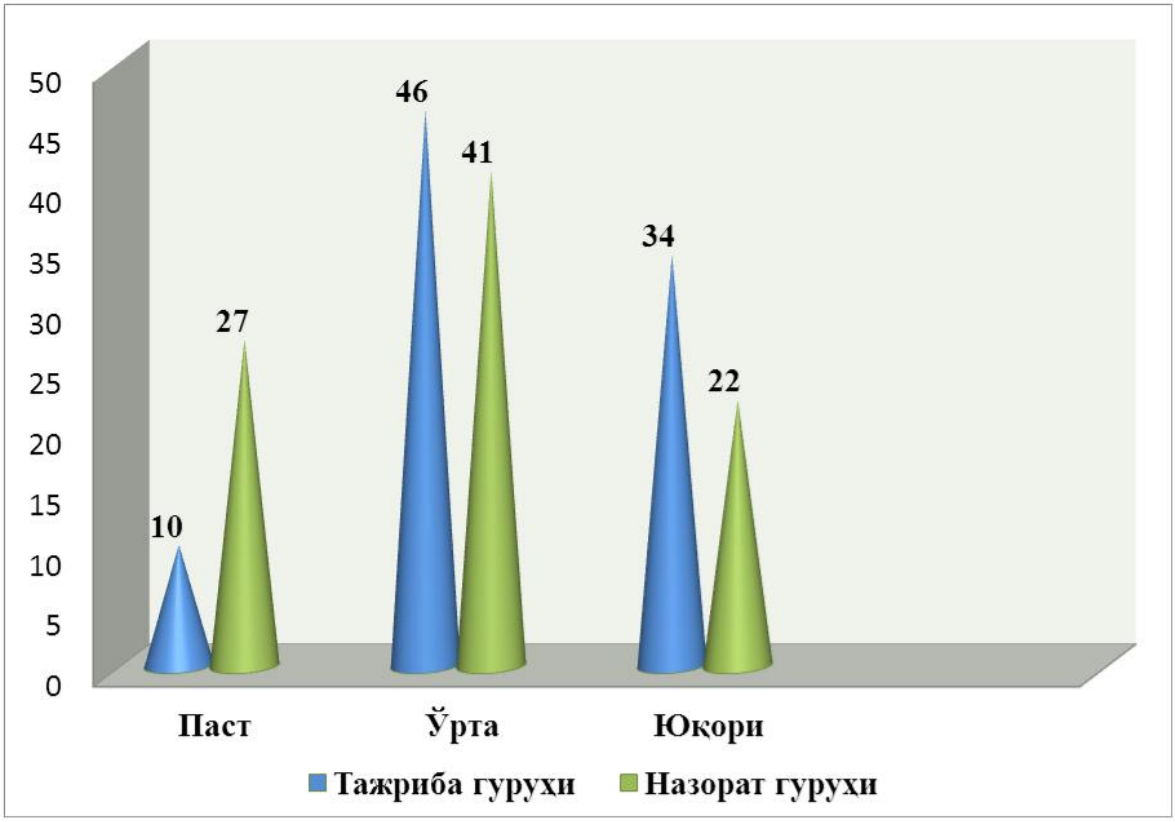


**Figure 3.9. Dynamics of 9th - grade students' mastery indicators in control and experimental groups**

From the plot recorded on the polygon, also the appropriate mean values for the samples $\overline{X} > \overline{Y}$ presupposes the satisfaction of the conditions. We calculate them based on the following formula:

$$\overline{X} = \frac{1}{n}\sum_{i=1}^{3} n_i X_i = \frac{1}{90}(34\cdot 5 + 46\cdot 4 + 10\cdot 3) = \frac{1}{90}(170 + 184 + 30) = \frac{384}{90} = 4{,}2666 \approx 4{,}3$$

$$\overline{Y} = \frac{1}{m}\sum_{j=1}^{3} n_j Y_j = \frac{1}{90}(22\cdot 5 + 41\cdot 4 + 27\cdot 3) = \frac{1}{90}(110 + 164 + 81) = \frac{355}{90} = 3{,}9444 \approx 3{,}9$$

So, the average mastery in the experimental group is higher than in the control group : $\overline{X} > \overline{Y}$ .
In percent

$$\frac{\overline{X}}{3}\cdot 100\% - \frac{\overline{Y}}{3}\cdot 100\% = \frac{4{,}2666}{3}\cdot 100 - \frac{3{,}9444}{3}\cdot 100 = \frac{32{,}22}{3} = 10{,}74\ \%$$



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Growth – $\bar{X}\% - \bar{Y}\% = 10,74\%$

So , experience is a test works at the end Knowledge of 9th grade students indicators medium in the account 10 to 74 % _ increased _

We calculate the dispersion coefficients for both groups. To this end, we first calculate the sample variances:

$$D_n = \sum_{i=1}^{3} \frac{n_i (x_i - \bar{X})^2}{n-1} = \frac{34(5-4,3)^2 + 46(4-4,3)^2 + 10(3-4,3)^2}{89} =$$

$$\frac{34 \cdot 0,49 + 46 \cdot 0,09 + 10 \cdot 1,69}{89} \approx \frac{16,66 + 4,14 + 16,9}{89} = \frac{37,7}{89} \approx 0,42$$

$$D_m = \sum_{j=1}^{3} \frac{n_j (y_j - \bar{Y})^2}{n-1} = \frac{22(5-3,9)^2 + 41(4-3,9)^2 + 27(3-3,9)^2}{89} =$$

$$\frac{22 \cdot 1,21 + 41 \cdot 0,01 + 27 \cdot 0,81}{89} \approx \frac{26,62 + 0,41 + 21,87}{89} = \frac{48,9}{89} \approx 0,55$$

From these results we find the mean squared deviations :

$$\tau_n = \sqrt{0,42} \approx 0,65; \qquad \tau_m = \sqrt{0,55} \approx 0,74;$$

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

$$\delta_n = \frac{\tau_n}{X} = \frac{0,65}{4,3} \approx 0,15; \ \delta_m = \frac{\tau_m}{Y} = \frac{0,74}{3,9} \approx 0,19;$$

Now we each two statistics selections theoretical medium values equality about $H_0$ : $a_X = a_Y$ the hypothesis Student criterion using we will check . That's it for the purpose of statistics we calculate :

$$T_{n,m} = \frac{\left|\bar{X} - \bar{Y}\right|}{\sqrt{\frac{S_X^2}{n} + \frac{S_Y^2}{m}}} = \frac{\left|4,26 - 3,94\right|}{\sqrt{\frac{0,39}{90} + \frac{0,55}{90}}} = \frac{0,32}{0,10} = 3,2$$

Student 95% of the criterion critical point $t_{kp}(0.95) = 1,96$ of statistics _ value from him enough is large : $T_{n,m} = 3,2 > 1.96 = t_{kp}(0.95)$

So , we $H_0$ the hypothesis refuse reached _ $\bar{Y} > \bar{X}$ and $a_x > a_y$ relationships attention received without , that is experience from work then , always average appropriation indicator previous appropriation from the indicator big will be he said _ conclusion do it we can

Based on the Student's criterion, we calculate the degree of freedom using the following formula:

$$K = \frac{\left(\frac{S_x^2}{n} + \frac{S_y^2}{m}\right)^2}{\frac{\left(\frac{S_x^2}{n}\right)^2}{n-1} + \frac{\left(\frac{S_y^2}{m}\right)^2}{m-1}} = \frac{\left(\frac{0,42}{90} + \frac{0,55}{90}\right)^2}{\frac{\left(\frac{0,42}{90}\right)^2}{89} + \frac{\left(\frac{0,55}{90}\right)^2}{89}} = 178,81$$

for this probability the value level of a statistical sign

$\alpha$ =If we take 0.05 , then *r* =1- $\alpha$=0.95 and degrees of freedom



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*k* = 1 78.81 is equal to The critical point of the binomial criterion from the Student's function distribution table:

$$t_{1-\frac{(1-p)}{2}}(k) = t_{1-\frac{(1-0,95)}{2}}(178,81) = t_{0,975}(178,81) = 1,96$$

Finally , we $X_i$ and $Y_i$ statistics of selections distribution laws equality about $K: F_x = F_y$ the hypothesis check for From the Pearson ( chi-square ) test we use



$$\chi^2 = \frac{1}{N \cdot M} \cdot \sum_{i=1}^{k} \frac{(n_i M - m_i N)^2}{n_i + m_i}.$$

This on purpose the following the table make up we get :

***3.8 - table***

| Grades / Guru xlar | 5 | 4 | 3 |
|---|---|---|---|
| Experience - from testing after | 34 | 4 6 | 10 |
| Experience - from testing before | 2 2 | 4 1 | 2 7 |

Pearson statistics we count ( n = m = 90 ) :

$$\chi^2 = \left( \frac{(34-22)^2}{34+22} + \frac{(46-41)^2}{46+41} + \frac{(10-27)^2}{10+27} \right) = 10,66$$

Pearson of the criterion freedom level points number to 1 is less : k =3 -1 =2 , this k =2 to corresponding to 95 % critical point $Z_{kp}(0,95) = 5,99$.

Therefore, the statistical analysis conducted on the results of the research and presented in the dissertation shows that the experimental work is effective and our intended goal is confirmed.

But , $\chi^2 = 10,66 > 5,99 = Z_{k,p}(0,95)$

So , K hypothesis too refuse meat it is This and experience is a test from work previous and next teaching of methodologies differentiation random not but _ legal always _ _ appropriation indicators to increase take will come it is

If we take the significance level of the statistical sign to $\alpha$=be 0.04, then the critical point for statistics from the Laplace function table is $t_{kn}$

$$\Phi(t_{kн}) = \frac{1-2\alpha}{2} = \frac{1-2 \cdot 0,04}{2} = \frac{0,92}{2} = 0,46$$

equation: $t_{kн} = 1,76$. From this, we find the reliable deviations of the experimental group estimates:

$$\Delta_n = t_{kн} \cdot \frac{D_n}{\sqrt{n}} = 1,76 \cdot \frac{0,42}{\sqrt{90}} = \frac{0,7392}{9,5} \approx 0,08$$

is equal to, and in the control group:

$$\Delta_m = t_{kн} \cdot \frac{D_m}{\sqrt{m}} = 1,76 \cdot \frac{0,55}{\sqrt{90}} = \frac{0,968}{9,5} \approx 0,1$$

is equal to

From the results experimental and control group for Reliable based on the idea of Neiman intervals found :

If we find a confidence interval for the experimental group from the results found:



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$$\bar{X} - t_{kн} \cdot \frac{D_n}{\sqrt{n}} \le a_x \le \bar{X} + t_{kн} \cdot \frac{D_n}{\sqrt{n}}$$

$$4{,}3 - 0{,}08 \le a_x \le 4{,}3 + 0{,}08$$

$$4{,}22 \le a_x \le 4{,}38$$

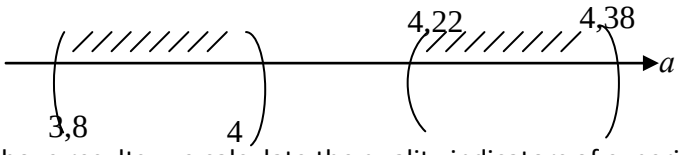
is equal to Confidence interval for the control group:



$$\bar{Y} - t_{kн} \cdot \frac{D_m}{\sqrt{m}} \le a_y \le \bar{Y} + t_{kн} \cdot \frac{D_m}{\sqrt{m}}$$

$$3{,}9 - 0{,}1 \le a_x \le 3{,}9 + 0{,}1 \quad 3{,}8 \le a_x \le 4$$

is equal to Their geometric representation is as follows:




Based on the above results, we calculate the quality indicators of experimental work.

We know $\overline{X}$ =4.3; $\bar{Y}$ =3.9; $\delta_n = 0{,}15$; $\delta_m = 0{,}19$ is equal to

From this, the teaching effectiveness indicator is determined as follows:

$$K_{усб} = \frac{(\bar{X} - \delta_n)}{(\bar{Y} + \delta_m)} = \frac{4{,}3 - 0{,}15}{3{,}9 + 0{,}19} = \frac{4{,}15}{4{,}09} = 1{,}01 > 1;$$

We calculate the level of knowledge with the following formula:

$$K_{бдб} = (\bar{X} - \delta_n) - (\bar{Y} - \delta_m) = (4{,}3 - 0{,}15) - (3{,}9 - 0{,}19) = 4{,}15 - 3{,}71 = 0{,}44 > 0;$$

From the obtained results, the evaluation criterion of teaching efficiency is greater than one *($K_{usb}$ =1.02>1)* and the evaluation criterion of knowledge level is greater than zero *($K_{bdb}$ =0.44>0)* . can be seen. It is known that the performance of the experimental group is higher than that of the control group.

Summing up from the above statistical analysis, it can be said that the test method of providing a uniform graphic layout in general secondary schools is effective, and the conducted pilot-test analyzes show that it can be used in the 8-9th grade physical and natural sciences classes of all general secondary schools of our republic, as well as independent use. is the basis for popularization.

**CONCLUSION**

According to the results of the research, the curricula, textbooks, and methodological literature of a number of subjects taught in grades 8-9 were studied, to what extent the images studied in drawing are used in science lessons, the uniqueness of the images used, and the content of the knowledge needed to perform the images used in various science lessons. , analyzing the results obtained from the study of general and specific features, learning ways to ensure a uniform graphic order (mode) at school became the basis for improving the didactic possibilities of increasing the quality and efficiency of graphic education, that is, the use of knowledge gained in drawing and various images in some subjects taught in grades 8-9 educational possibilities and peculiarities of the use of images in geometry, algebra, physics, chemistry, informatics, geography and technology lessons were studied, their types and quantity were determined. Analysis has shown that graphic materials are used a lot in the science of geometry.



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The educational possibilities and uniqueness of using the knowledge gained in drawing and various images in some subjects taught in grades 8-9 were determined. In the process of solving this problem, the specificity of the use of images in geometry, algebra, physics, chemistry, computer science, geography and technology lessons was studied, their types and quantity were determined. The identified features showed that the most common image in various disciplines is projections (with clipping) in one plane. We can find graphic images of this category in geometry, algebra, physics, technology, chemistry, geography, computer science classes. Therefore, the use of the laws of drawing in the explanation of educational materials related to these subjects serves to increase not only graphic education, but also the quality and efficiency of education in a particular subject. Also, there are diagrams in the teaching materials of concrete and natural sciences, and without these images, the process of explaining some topics is relatively complicated. Educational materials presented with the help of graphic images have a positive effect on the quality of education due to the high level of perception by students.

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