

RESULTS OF EXPERIMENTAL WORK AIMED AT IMPROVING THE EFFECTIVENESS OF METHODOLOGICAL PREPARATION OF FUTURE PRIMARY TEACHERS FOR SPIRITUAL ACTIVITY**Nabiyeva Dilfuza Temirovna**Assistant of samarkand state
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Abstract: This article reflects the results of experimental work aimed at the effectiveness of improving materials with spiritual content using innovative technologies, using the capabilities of the discipline “Theory and methodology of natural sciences” in the methodological preparation of future primary school teachers for spiritual activities.

Keywords: prospective primary school teacher, primary school students, experimental testing, criteria, cognitive, creative, motivational, progressive, control group, experimental group, foundational, formative and confirmatory, statistical analysis.

РЕЗУЛЬТАТЫ ОПЫТНО-ЭКСПЕРИМЕНТАЛЬНОЙ РАБОТЫ, НАПРАВЛЕННОЙ НА ПОВЫШЕНИЕ ЭФФЕКТИВНОСТИ МЕТОДИЧЕСКОЙ ПОДГОТОВКИ БУДУЩИХ УЧИТЕЛЕЙ НАЧАЛЬНЫХ КЛАССОВ К ДУХОВНО-ОБРАЗОВАТЕЛЬНОЙ ДЕЯТЕЛЬНОСТИ

Аннотация: В данной статье отражены результаты экспериментальной работы, направленной на эффективность совершенствования материалов духовного содержания с использованием инновационных технологий, использующих возможности дисциплины «Теория и методология естествознания» в методической подготовке будущих учителей начальных классов к духовной деятельности.

Ключевые слова: будущий учитель начальной школы, учащиеся начальной школы, экспериментальное тестирование, критерии, когнитивные, творческие, мотивационные, прогрессивные, контрольная группа, экспериментальная группа, основополагающие, формирующие и подтверждающие, статистический анализ.

Experimental work aimed at improving the effectiveness of methodological preparation of future primary school teachers for spiritual activities is aimed at clarifying the results obtained at the beginning and end of the experiment, the level of improvement and effectiveness of methodological preparation of future primary school teachers for the spiritual education of primary school students in classroom lessons, independent learning and extracurricular activities in the process of teaching the subject “Theory and methodology of natural sciences”.

An important stage of research work is testing the developed theory in practice and analyzing the results.

The pilot study was conducted in the 2020-2025 academic years. A total of 582 prospective primary school teachers from Bukhara state University, Jizzakh state Pedagogical institute, Samarkand state University, and the Uzbek-Finnish Pedagogical institute (now Samarkand state Pedagogical institute) participated. 290 students participated in the experimental group and 292 in the control group. The results were compared and the dynamics of development according to the established criteria were studied.

Initially, a pilot program was developed. Based on the plan of this program, the pilot work was divided into three stages: foundational, formative, and confirmatory (final) stages.

The foundational stage was carried out in the 2020-2021 academic year. First of all, the problem under study, the requirements of the regulation on the rules and procedure for conducting pedagogical experimental testing, then, evaluation criteria, pedagogical observation, interview, test, questionnaire survey, group expert assessment, mathematical statistical analysis, and methods for summarizing the results of the analysis were studied and developed.

The assessment criteria that determine the level of methodological preparation of future primary school teachers for the spiritual education of primary school students are: cognitive, creative, motivational, progressive. These criteria allow us to determine the level of improvement of the methodological preparation of future primary school teachers for spiritual activities.

The formative stage was held in the 2021-2022 academic year, during which the foundational experimental work was completed and conclusions were drawn. At this stage, special methodological developments were carried out for the participating students of the Experimental Group to improve methodological preparation for spiritual activities based on the materials of the subject "Theory and methodology of natural Sciences", individual, group, collective tasks, projects, and methods that activate the educational process.

In the control groups, current educational literature and the experience of professors and pedagogues were used. Sample tests, questionnaires, and interview topics were developed and distributed to future primary school teachers, as necessary. Based on the materials of the subject "Theory and methodology of natural sciences", some shortcomings in methodological preparation for spiritual activities were identified and corrected, and the reliability of the improved methodology was checked.

The third confirming (final) stage of pilot testing will cover the 2023-2025 academic year.

From the experimental-testing work, the number of students in the experimental groups is $n=290$, and the number of students in the control groups is $m=292$, and we consider these numbers as the sizes of statistical samples corresponding to the X_i and Y_j variants. We analyzed the average mastery of the experimental and control groups in higher educational institutions using the mathematical and statistical method of Student and K. Pearson "Chi-square".

($n = n_1 + n_2$ va $m = m_1 + m_2 + m_3$):

Learning indicators in the experimental group:

$$\begin{cases} X_i & 3 & 2 & 1 \\ n_i & 136 & 120 & 34 \end{cases} \quad n = \sum_{i=1}^3 n_i = 290$$

Acquisition indicators in the control group:

$$\begin{cases} Y_j & 3 & 2 & 1 \\ m_j & 76 & 116 & 100 \end{cases} \quad m = \sum_{j=1}^3 m_j = 292$$

Here: - the number of students in the experimental group; - the number of students in the control group.

X_i - number of measurements in the experimental group,

($X_i = 3$) that is, "High level", ($X_i = 2$) "Intermediate level", ($X_i = 1$) "Lower level".

Y_j - number of measurements in the control group ($Y_j = 3$), that is, "High level", ($Y_j = 2$) "Intermediate level", ($Y_j = 1$) "Lower level".

At the final stage of the pedagogical pilot test, the indicators of the level of improvement of the methodological preparation of future primary school teachers for spiritual activities at all pilot test sites are presented in Table 1.

Table 1.

Results of pedagogical experiments conducted at all experimental sites

	Control group (m=292)	Experimental group (n=290)
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Student achievement level	At the beginning of the experiment		At the end of the experiment		At the beginning of the experiment		At the end of the experiment	
	Count	Percentage	Count	Percentage	Count	Percentage	Count	Percentage
High	73	25 %	76	26%	74	26 %	136	47%
Medium	113	48%	116	40%	116	40%	120	41%
Lower	106	37%	100	34%	100	34%	34	12%
Total:	292		292		290		290	

As can be seen from the diagram, the high 136 and the middle 120 indicators in the experimental group are higher than the high 76 and the middle 116 indicators in the control group. Each of the diagrams drawn shows that it is possible to put forward the hypothesis that the statistical table is drawn from empty sets with a normal distribution.

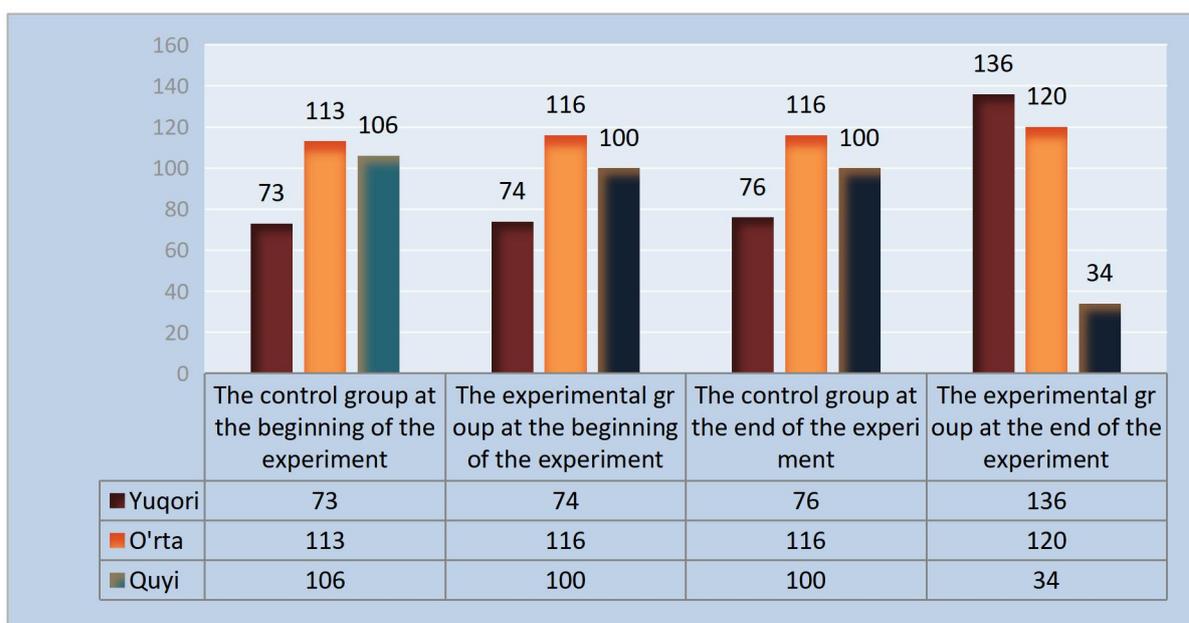


Figure 1. Diagram of student learning outcomes in the control and experimental groups at the experimental sites.

In order to facilitate statistical analysis, the frequencies n_i and m_j from the above variation series are converted into appropriate statistical probability formulas.

$p_i = \frac{n_i}{n}$ and $q_j = \frac{m_j}{m}$ we calculate based on.

$$\begin{cases} X_j & 3 & 2 & 1 \\ n_i & 0,47 & 0,41 & 0,12 \end{cases} \quad \sum_{i=1}^3 p_i = 1$$

$$\begin{cases} Y_j & 3 & 2 & 1 \\ m_j & 0,26 & 0,40 & 0,34 \end{cases} \quad \sum_{j=1}^3 q_j = 1$$

We begin the statistical analysis by calculating and comparing the average mastery scores for both groups. The average mastery scores yielded the following results: Average mastery scores in the experimental group.

$$\bar{X} = \sum_{i=1}^{n=3} p_i X_i = 0,47 \cdot 3 + 0,41 \cdot 2 + 0,12 \cdot 1 = 1,41 + 0,84 + 0,12 = 2,37$$

In percent

$$\bar{X}\% = \frac{2,37}{3} \cdot 100\% \approx 79\%$$

Average learning outcomes in the control group:

$$\bar{Y} = \sum_{j=1}^{m=3} q_j Y_j = 0,47 \cdot 3 + 0,40 \cdot 2 + 0,34 \cdot 1 = 0,78 + 0,80 + 0,34 = 1,92$$

In percent

$$\bar{Y}\% = \frac{1,92}{3} \cdot 100\% \approx 64\%$$

So, the average mastery in the experimental group is higher than the average mastery in the control group by $(79-64)\% = 15.0\%$.

Now let's move on to estimating the errors of the experimental work. First, we calculate the variances of the samples:

$$S_X^2 = \sum_{i=1}^3 p_i X_i^2 - (\bar{X})^2 = 0,47 \cdot 9 + 0,41 \cdot 4 + 0,12 \cdot 1 - (2,37)^2 = 0,3731$$

Standard deviation: $S_X = \sqrt{0,3731} = 0,61$

$$S_Y^2 = \sum_{j=1}^3 q_j Y_j^2 - (\bar{Y})^2 = 0,26 \cdot 9 + 0,40 \cdot 4 + 0,34 \cdot 1 - (1,92)^2 = 0,5936$$

Standard deviation: $S_Y = \sqrt{0,5936} \approx 0,77$.

We calculate the percentage deviation of these errors from the mean values using the coefficients of variation.

To show this more clearly, we calculate the mean value precision for both statistical samples using the coefficients of variation, that is, C_x and C_y , using the formula:

$$C_x = \frac{S_x}{\sqrt{n \cdot X}} \cdot 100\% = \frac{0,61 \cdot 100\%}{\sqrt{290 \cdot 2,37}} = \frac{61\%}{17,03 \cdot 2,37} = \frac{61\%}{40,3611} \approx 1,51\%$$

$$C_y = \frac{S_y}{\sqrt{m \cdot Y}} \cdot 100\% = \frac{0,77 \cdot 100\%}{\sqrt{292 \cdot 1,92}} = \frac{77\%}{17,09 \cdot 1,92} = \frac{77\%}{32,8128} \approx 2,35\%$$

Both error rates are well below the 5% limit, which indicates that the experimental work was satisfactory.

Now we test the hypothesis $H_0: a_x = a_y$ that the theoretical means of two statistical samples are equal using the Student's t-test.

At this end, we calculate the appropriate statistics:

$$T_{n,m} = \frac{|\bar{X} - \bar{Y}|}{\sqrt{\frac{S_X^2}{n} + \frac{S_Y^2}{m}}} = \frac{|2,37 - 1,92|}{\sqrt{\frac{0,3731}{290} + \frac{0,5936}{292}}} \approx \frac{0,44}{0,056} \approx 8,30$$

The significance level of a statistical sign for probability

$\alpha = 0,05$ deb Let's say, and $r = n+m-2$ from the table by the number of degrees of freedom $t_{kr}(0,05;582)=1,96$ a critical value is found. $T_{emp}=8,30 > 1,96 = t_{kr}(0,05;582)$

Therefore, we reject the H_0 hypothesis,

$\bar{X} > \bar{Y}$ taking into account the relationships $a_x > a_y$, That is, we conclude that the average mastery scores in the test group will always be greater than the previous mastery score.

Finally, we X_i end Y_i on the equality of distribution laws of statistical samples $K : F_x = F_y$ Pearson to test the hypothesis (xi-square) We use the criterion.

$$\chi_{n,m}^2 = \frac{1}{N \cdot M} \cdot \sum_{i=1}^k \frac{(n_i M - m_i N)^2}{n_i + m_i}$$

For this purpose, we will compile the following table: (see Table 3).

Table 3.
Pearson criterion calculation table

Grades	3	2	1
Groups			
Experimental group	136	120	34
Control group	76	116	100

We calculate the Pearson statistic: Pearson's degree of freedom $k=(s-1) (r-1)=(2-1)(3-1)=2$, the is $k=2$ suitable for 95% critical point.

$$Z_{kr}(0,95)=5,99$$

But, $\chi_{n,m}^2=56,51 > 5,99 = Z_{kr}(0,95)$

Therefore, the K hypothesis is also rejected. This means that the difference in teaching methods in the experimental and control groups from the experimental work is not accidental, but rather legal, and always leads to an increase in mastery indicators. Now we find a reliable interval for determining the effectiveness of the assessment: for the experimental group.

$$\Delta_x = t_y \cdot \frac{S_x}{\sqrt{n}} = 1,96 \cdot \frac{0,61}{\sqrt{290}} = 1,96 \cdot \frac{0,61}{17,03} = \frac{1,1956}{17,03} \approx 0,07$$

equal to, and in the control group:

$$\Delta_y = t_y \cdot \frac{S_y}{\sqrt{n}} = 1,96 \cdot \frac{0,77}{\sqrt{292}} = 1,96 \cdot \frac{0,77}{17,09} = \frac{1,5092}{17,09} \approx 0,09 \text{ is equal to } .$$

From the results obtained, we find the confidence interval for the experimental group:

$$\bar{X} - \Delta_x \leq a_x \leq \bar{X} + \Delta_x$$

$$2,37 - 0,07 \leq a_x \leq 2,37 + 0,07$$

$$2,30 \leq a_x \leq 2,44$$

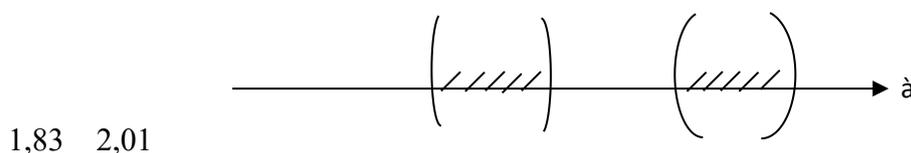
confidence interval for the control group:

$$\bar{Y} - \Delta_y \leq a_y \leq \bar{Y} + \Delta_y$$

$$1,92 - 0,09 \leq a_y \leq 1,92 + 0,09$$

$$1,83 \leq a_x \leq 2,01$$

Let's describe this geometrically:



In this $\alpha=0,05$ With a significance level, it can be said that the average score in the experimental group is higher than the average score in the control group, and the intervals between them do not overlap. Therefore, based on mathematical and statistical analysis, it was found that a good result was achieved.

Based on the above results, mathematical statistical analysis was performed to find the mean values, sample variance, variation indices, Student's t-test, degrees of freedom based on Student's t-test, Pearson's t-test, and reliable deviations for the final state of the experiment (see Table 4). Statistical indicators of pilot work on methodological preparation of future primary school teachers for spiritual activity.

Table 4.

\bar{X}	\bar{Y}	S_x^2	S_y^2	C_x	C_y	$T_{x,y}$	K	$X_{n,m}^2$	Δ_x	Δ_y
2,37	1,92	0,3731	0,5936	1,51	2,35	8,30	582	56,51	0,07	0,09

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

We know $\bar{X}=2,37$; $\bar{Y}=1,92$; $\Delta_x=0,07$ $\Delta_y=0,09$

is equal to.

From this, qualitative indicators:

$$K_{usb} = \frac{(\bar{X} - \Delta_x)}{(\bar{Y} + \Delta_y)} = \frac{2,37 - 0,07}{1,92 + 0,09} = \frac{2,30}{2,01} \approx 1,14 > 1;$$

$$K_{bdb} = (\bar{X} - \Delta_x) - (\bar{Y} - \Delta_y) = (2,37 - 0,07) - (1,92 - 0,09) = 2,30 - 1,83 = 0,47 > 0;$$

In conclusion, the results of the mathematical and statistical analysis can be seen as a criterion for assessing the effectiveness of education in methodological preparation of future primary school teachers for spiritual activity with a value of one, and a criterion for assessing the level of development of the spiritual activity of future primary school teachers with a value of zero.

The above statistical analyses show that the conclusions drawn from the research results and presented in the dissertation indicate that the effectiveness of the experimental work is 15.0% and that our goal has been confirmed.

The results confirm the increase in students' general pedagogical understanding, laws and regulations, knowledge, skills, and qualifications.

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