ANALYSIS OF THE RESULTS OF EXPERIMENTAL WORK ON IMPROVEMENT OF PROFESSIONAL SKILLS OF PRESCHOOL TEACHERS

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ABSTRACT

This article deals with statistical analysis of the research results, conclusions on the effectiveness of methodologies used in the professional development of preschool teachers.

INTRODUCTION, LITERATURE REVIEW AND DISCUSSION

The use of modern technologies in the system of advanced training guarantees the professional development of preschool teachers.

At the end of professional development course, which was conducted by special program a pre-course and post-course questionnaire was administered to questionnaires in the experimental and control groups to identify their knowledge and skills. The results can be seen in the following tables.

Table 1

№	**Questionnaire questions**	**Pre-course n=218+220 (N and T gr)***		**Post-course n-220 (T gr)****	
		total	**%**	**total**	**%**
1	Modern technology is...	113	26	190	86
2	What is interactive methods...	85	19	182	83
3	Developmental educational technology is ...	78	18	147	67
4	Innovational activity is …...	97	22	192	87
5	What is cooperative technology?	67	15	117	53
6	What methods are useful for working with parents?	87	20	184	84
7	What are state demands for developing preschool and primary children?	117	27	203	92
8	What are the purposes of preschool teaching process according to the Firt Step state program?	97	22	195	87
9	What are the criteria of organizing preschool education process?	73	17	197	89
10	What do you think about competency approach in teaching preschool children?	69	16	199	90
	Average	88	20	181	82

(N and T gr.) * - number of educators in control and experimental groups.
(T gr.) ** - number of students in the experimental group.

Based on the results of the above table, we examined the results of experimental tests to determine the effectiveness of educators in the development of a special course program "Modern approaches to pre-school education" by examining the results of the control groups using a mathematical and statistical method.

Table 2

Groups	**Degree indicators (according to the number of respondents)**		
	High	**Medium**	**Law**
In the beginning of experience (220 experimental groups)	73	106	41
At the end of the experience (218 experimental groups)	140	65	13

We obtain the following statistical grouped variance series by determining the number of trainees in the experimental group and the number of caretakers to sign them as $X_i n_i$ and $Y_j m_j$ in the control groups. We assess high level with 3 points, medium 2 points, law 1 point.
Learning outcomes in the experimental group:

$$(1)\begin{cases} X_i & 3; \quad 2; \quad 1; \\ n_i & 140; \quad 65; \quad 13; \end{cases}$$

$$n = \sum_{i=1}^{3} n_i = 218$$

Acquiring indicators of control group:

$$(2)\begin{cases} Y_i & 3; \quad 2; \quad 1; \\ m_j & 73; \quad 106; \quad 41; \end{cases} \quad m = \sum_{j=1}^{3} m_j = 220$$

The diagram that matches these choices looks like this:

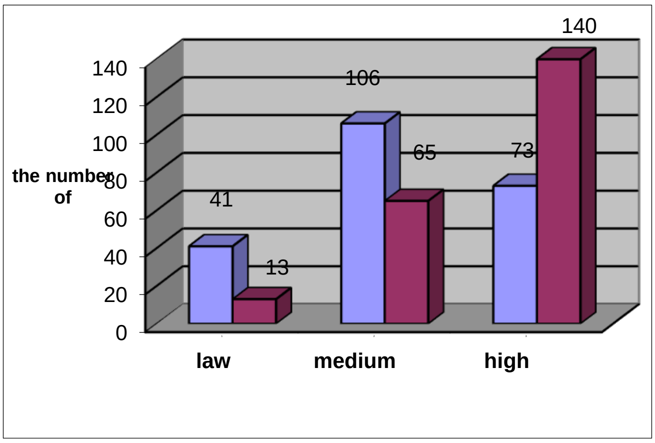


Figure 1. Blue diagram color is control group; purple one is experimental group.

We calculate appropriate statistical probability formulas for the above variation series n_i and m_j repetitions for facilitating statistical analysis

$$P_i = \frac{n}{n_i} \quad \text{ва} \quad q_j = \frac{m}{m_j}$$

(3)

$$\begin{cases} X_i & 3; & 2; & 1; \\ n_i & 0{,}64; & 0{,}3; & 0{,}06; \end{cases}$$

$$\sum_{i=1}^{3} P_i = 1 \quad (4)$$

$$\begin{cases} Y_j & 3; & 2; & 1; \\ m_j & 0{,}33; & 0{,}48; & 0{,}19; \end{cases}$$

$$\sum_{j=1}^{3} q_j = 1 \quad (5)$$

We begin the statistical analysis by comparing the mean scores for both groups. The results of the average performance showed the following results:

$$\overline{X} = \sum_{i=1}^{n=3} P_i X_i = 0{,}64 \cdot 3 + 0{,}3 \cdot 2 + 0{,}06 \cdot 1 = 1{,}92 + 0{,}6 + 0{,}06 = 2{,}58$$

In percentage $\overline{X}\% = \frac{2{,}58}{3} \cdot 100\% = 86\%$

$$\overline{Y} = \sum_{j=1}^{m=3} q_j Y_j = 0{,}33 \cdot 3 + 0{,}48 \cdot 2 + 0{,}19 \cdot 1 = 0{,}99 + 0{,}96 + 0{,}19 = 2{,}14$$

In percentage $\overline{Y}\% = \frac{2{,}14}{3} \cdot 100\% = 71{,}3\%$

Hence, the average assimilation in the experimental group (86–71.3) $\% = 14.7\%$. This, in turn, means that it is twice much $\frac{86\%}{71{,}3\%} = 1{,}21$.

In order to identify possible errors in the assimilation process, we first determine the medium quadratic and standard errors.
Medium quadratic errors:

$$S_x^2 = \sum_{i=1}^{n=3} P_i X_i^2 - (\overline{X})^2 = 0{,}64 \cdot 3^2 + 0{,}3 \cdot 2^2 + 0{,}06 \cdot 1^2 - 2{,}58^2 = 0{,}64 \cdot 9 + 0{,}3 \cdot 4 + 0{,}06 \cdot 1 - 6{,}6564 =$$

$$= 5{,}76 + 1{,}2 + 0{,}06 - 6{,}6564 = 7{,}02 - 6{,}6564 = 0{,}3636$$

$$S_y^2 = \sum_{j=1}^{m=3} q_j Y_j^2 - (\overline{Y})^2 = 0{,}33 \cdot 3^2 + 0{,}48 \cdot 2^2 + 0{,}19 \cdot 1^2 - 2{,}14^2 = 0{,}33 \cdot 9 + 0{,}48 \cdot 4 + 0{,}19 \cdot 1 - 4{,}5796 =$$

$$= 2{,}97 + 1{,}92 + 0{,}19 - 4{,}5796 = 5{,}08 - 4{,}5796 = 0{,}5004$$

Standard errors:

$$S_x = \sqrt{0{,}3636} = 0{,}6 \quad S_y = \sqrt{0{,}5004} = 0{,}71$$

Furthermore, the standard error of the control group becomes experimental group indicators, it means that 0,6 <0,71. To illustrate this more accurately, we calculate the medium values for both statistical variables using the coefficients of variation, that is, the formula C_x and C_y:

$$C_x = \frac{S_x}{\sqrt{n} \cdot \overline{x}} \cdot 100\% = \frac{0{,}6 \cdot 100\%}{\sqrt{218} \cdot 2{,}58} = \frac{60\%}{14{,}76 \cdot 2{,}58} = \frac{60\%}{38{,}08} = 1{,}58\% \approx 2\%$$

$$C_y = \frac{S_y}{\sqrt{m} \cdot \overline{y}} \cdot 100\% = \frac{0{,}71 \cdot 100\%}{\sqrt{220} \cdot 2{,}14} = \frac{71\%}{14{,}83 \cdot 2{,}14} = \frac{71\%}{31{,}74} = 2{,}24\% \approx 2\%$$

Thus, the accuracy of the medium score in the experimental group differs to one unit from the control group.

Now let's examine the null hypothesis based on the Student chosen criterion, taking into consideration given the similarity of unknown medium sum of two main collection:

$$H_0 : \mu = \mu_y$$

Based on this, we do the following calculation:

$$T_{x,y} = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{S_x^2}{n} + \frac{S_y^2}{m}}} = \frac{2,58 - 2,14}{\sqrt{\frac{0,3636}{218} + \frac{0,5004}{220}}} = \frac{0,44}{\sqrt{0,0017 + 0,0023}} = \frac{0,44}{\sqrt{0,004}} = \frac{0,44}{0,063} = 6,98$$

We calculate the degree of freedom based on the Student criteria by the following formula:

$$k = \frac{\left(\frac{S_x^2}{n} + \frac{S_y^2}{m}\right)^2}{\frac{\left(\frac{S_x^2}{n}\right)^2}{n-1} + \frac{\left(\frac{S_y^2}{m}\right)^2}{m-1}} = \frac{\left(\frac{0,3636}{218} + \frac{0,5004}{220}\right)^2}{\frac{\left(\frac{0,3636}{218}\right)^2}{217} + \frac{\left(\frac{0,5004}{220}\right)^2}{219}} = \frac{(0,0016 + 0,0023)^2}{\frac{(0,0017)^2}{217} + \frac{(0,0023)^2}{219}} =$$

$$= \frac{(0,004)^2}{\frac{0,0000029}{217} + \frac{0,0000053}{219}} = \frac{0,000016}{0,000000013 + 0,000000024} = \frac{0,000016}{0,000000037} = 432,43$$

Taking the statistical significance value for this probability is **α**=0,05, then p = 1-**α**= 0,95 and the degree of freedom is k = 432,43. The critical point of the binary criterion from the student function distribution table:

$$t_{1-\frac{(1-p)}{2}}(k) = t_{1-\frac{(1-0,95)}{2}}(432,43) = t_{0,975}(432,43) = 1,96$$

This shows that the sum of the statistics choice is bigger than critical point:

$$T_{x,y} = 6,98 > 1,96$$

Thus, the H_0 null hypothesis of main medium sums equality is rejected. It can be said with 95% certainty that the average levels of assimilation in the experimental groups have always been higher than the average in the control groups, and they never go up.

We now see that the teaching methods in the experimental groups and control groups are different, which is contrary to our hypothesis.

$$K_0 : F_x = F_y$$

Here, the distribution of the two main collections are consistent with each other.

To test the hypothesis that H_1: - the bundle is normally distributed at a given value of α, we first calculate the theoretical frequencies and then the Pearson's Conformity Criteria in the following formula in the Xi-square (6) and (7) systems:

$$X^2_{n,m} = \frac{1}{n \cdot m}\sum_{i,j=1}^{3}\frac{(nm_j - mn_i)^2}{m_j + n_i} = \sum_{i,j=1}^{3}\frac{(m_j - n_i)^2}{m_j + n_i}.$$

According to the formula $X^2_{n,m}$ equals to:

$$X^2_{n,m} = \frac{(140-73)^2}{140+73} + \frac{(65-106)^2}{65+106} + \frac{(13-41)^2}{13+41} = \frac{4489}{213} + \frac{1681}{171} + \frac{784}{54} = .$$

$$= 21{,}08 + 9{,}83 + 14{,}51 = 45{,}43$$

According to this criterion, the degrees of freedom are v = 3 - 1 = 2, we find the critical point in the table of the Xi-square distribution. Reliability probability for p= 0.95 equals to

$t_{0,95}(V) = t_{0,95}(2) = 6$.

We construct a right-sided critical area since the one-sided criterion rejects the null hypothesis “more firmly” than the binary criterion. The right critical field equals to:

$X^2_{n,m}$ = 45,43 >6 = $t_{0,95}$

Since the Xi-square distribution is larger than the critical point, the null hypothesis is rejected. Now we find a reliable interval to determine the effectiveness of the evaluation and it equals to:

$$\Delta_x = t_\gamma \cdot \frac{S_x}{\sqrt{n}} = 1{,}96 \cdot \frac{0{,}6}{\sqrt{218}} = 1{,}96 \cdot \frac{0{,}6}{14{,}76} = \frac{1{,}176}{14{,}76} \approx 0{,}08.$$

In control group it equals to:

$$\Delta_x = t_\gamma \cdot \frac{S_y}{\sqrt{m}} = 1{,}96 \cdot \frac{0{,}71}{\sqrt{220}} = 1{,}96 \cdot \frac{0{,}71}{14{,}83} = \frac{1{,}3916}{14{,}83} \approx 0{,}09.$$

From the results we find a reliable interval for the experimental group:

$$\overline{X} - \Delta_x \le a_x \le \overline{X} + \Delta_x$$

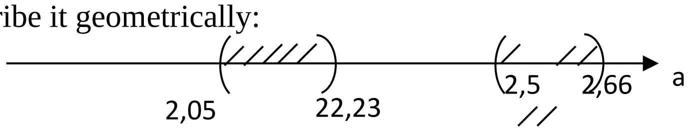
$$2{,}58 - 0{,}08 \le a_x \le 2{,}58 + 0{,}08 \quad 2{,}5 \le a_x \le 2{,}66$$

Reliable interval for the control group:

$$\overline{Y} - \Delta_y \le a_y \le \overline{Y} + \Delta_y$$

$$2{,}14 - 0{,}09 \le a_y \le 2{,}14 + 0{,}09 \quad 2{,}05 \le a_y \le 2{,}23$$

If we describe it geometrically:



With a value of x = 0,05 we can say that the medium score in the experimental group is higher than the mean in the control group, and the intervals do not overlap. Thus, based on mathematical and statistical analysis, it was found that good results were obtained.

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

It is clear that the following equals to $\overline{X}$ =2,58; $\overline{Y}$ =2,14; $\Delta_x = 0{,}08$; $\Delta_y = 0{,}09$

Quality indicators:

$$Kusb = \frac{(\overline{X} - \Delta_x)}{(\overline{Y} + \Delta_y)} = \frac{2{,}58 - 0{,}08}{2{,}14 + 0{,}09} = \frac{2{,}5}{2{,}23} = 1{,}12 > 1;$$

$$Kbdb = (\overline{X} - \Delta_x) - (\overline{Y} - \Delta_y) = (2{,}58 - 0{,}08) - (2{,}14 - 0{,}09) = 2{,}5 - 2{,}05 = 0{,}45 > 0;$$

From the results we can see that the criterion for assessing the effectiveness of teaching is more than one and that the knowledge evaluation criteria is greater than zero.

Thus, the statistical analysis of the effectiveness of the pilot tests to improve the effectiveness of the training courses of educators is evident.

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