

## EXPERIMENTAL VERIFICATION OF THE EFFECTIVENESS OF THE DISTANCE LEARNING SYSTEM INFLUENCE ON THE LEVEL OF DEVELOPMENT OF PROFESSIONAL AND PEDAGOGICAL COMPETENCE OF PRIMARY SCHOOL TEACHERS

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### ABSTRACT

The article presents the results of the pedagogical experiment of the effectiveness of the distance learning system on the level of development of professional and pedagogical competence of primary school teachers. The effectiveness of the implementation of the developed system of distance learning of primary school teachers in the development of professional and pedagogical competence was tested taking into account the comparative method of research, the essence of which was to compare the results of the ascertaining stage with the formative during the experiment. In the process of the research the following was introduced: the subsystem of professional and pedagogical improvement of distance learning organizers, educational and methodological support of the process of forming the readiness of primary school teachers for distance learning and the system of distance learning of primary school teachers. The educational process was carried out as follows: an introductory face-to-face session, distance learning and an examination (final) session. At the formative stage of the pedagogical experiment, similar methods were used to diagnose the development of professional and pedagogical competence of primary school teachers, which were used at the ascertaining stage. The main components of diagnostics are theoretical-and-methodological and psychological-and-pedagogical preparation of primary school teachers for professional and pedagogical activities. The pedagogical experiment proved the effectiveness of the developed system of distance learning of primary school teachers. The final stage of the experiment showed that most primary school teachers have increased the level of professional and pedagogical competence. According to the results of statistical processing of the tests of the participants of the experiment a significant increase in the parameters of all blocks of measured levels was noted.

**Keywords:** distance learning system, professional and pedagogical competence, experimental group, primary school teachers, teachers, pedagogical experiment, distance learning, diagnostics.

### INTRODUCTION

Enriching spiritual culture, restoring ties with national sources and developing the intellectual potential of the individual in the context of reforming education requires, from the first days at school, application of innovations and a system of methods that promote not only students' acquisition of knowledge, skills

and abilities, but also self-improvement and self-education. In view of this, the professional training of primary school teachers is undergoing certain changes and is aimed at the use of innovative teaching technologies and modernization of traditional ones.

Various aspects of professional training of teachers are revealed in the works of Victor Andrushchenko (Andrushchenko, 2016), Elena Dubasenyuk (Dubasenyuk, 2018), Vasily Kremen (Kremen, 2015), Anatoly Kuzminsky (Kuzminsky, 2018), Vladimir Lugovoi (Lugovyi, 2020), Larisa Lukyanova (Lukyanova, 2020), Nela Nychkalo (Nychkalo, 2008) and others. Theoretical and practical principles of training primary school teachers are reflected in the research of Volodymyr Bondar (Bondar, 2012), Olga Komar (Komar, 2018), Yevhen Lodatko (Lodatko, 2015), Maryana Marusynets (Marusynets, 2012), Lyubov Petukhova (Petukhova, 2017), Alexandra Savchenko (Savchenko, 2018), Svetlana Skvortsova (Skvortsova, 2013), Lydia Khomych (Khomych, 2019) and others.

However, the problem of the effectiveness of theoretical and methodological support for distance learning of primary school teachers in the system of their continuing education has not yet been the subject of a holistic analysis of scientists.

## **THE PURPOSE OF THE ARTICLE**

The purpose of the article – is to experimentally test the effectiveness of the distance learning system on the level of development of professional and pedagogical competence of primary school teachers.

The reliability and validity of the results of experimental work was established by Pearson's method: determination of the arithmetic mean, testing of zero and alternative hypotheses using the criterion  $\chi^2$ .

## **MAIN MATERIAL STATEMENT**

The effectiveness of the implementation of our distance learning (DL) system of primary school teachers (Mukoviz, Veremienko & Melnychuk, 2019) in the development of professional and pedagogical competence was tested taking into account the comparative method of scientific research, the essence of which is to compare the results of the statement stage with the formative stage during the pedagogical experiment.

One of the main tasks of our study was to experimentally test the effectiveness of the DL system on the development of professional and pedagogical competence of primary school teachers.

The number of participants in the pedagogical experiment remained unchanged, the same number of respondents who were involved in the ascertaining stage: experimental group (EG) – 960 people, expert group – 48 teachers of pedagogical universities (Mukoviz, 2021).

During the pedagogical experiment were introduced:

- Subsystem of professional and pedagogical improvement of DL organizers (<https://sno.udpu.edu.ua>).
- Educational and methodological support for the process of forming the readiness of primary school teachers for DL (<http://dls.udpu.edu.ua>): EG respondents were introduced to electronic training courses "Information and communication technologies in primary education" and "Fundamentals of distance learning in primary education". Teaching in the control groups was carried out according to the traditional system (within the curricula of pedagogical universities), in particular, teachers worked with the usual program of the course "Information and Communication Technologies in Primary Education", which studies information technology "as

a thing in itself", e.g. without directing DL technologies to professional activities, "Fundamentals of distance learning in primary education" did not study.

- The system of DL of primary school teachers (Mukoviz, Veremienko & Melnychuk, 2019).

The educational process was carried out as follows: an introductory face-to-face session, distance learning and an examination (final) session.

At the formative stage of the pedagogical experiment similar methods were used to diagnose the development of professional and pedagogical competence of primary school teachers, which were used at the ascertaining stage (theoretical-and-methodological and psychological-and-pedagogical training of primary school teachers for professional and pedagogical activities) (Mukoviz, 2021).

Having qualimetric indicators according to the methods of diagnostics of the identified levels of professional and pedagogical competence of primary school teachers by diagnostic blocks, we correlated the sums of points in the relevant component of competence with the total number of points and translated into percentages calculated by formula 1:

$$P = \frac{\sum_n}{\sum_m} \times 100\%$$

(1)

P – level of development of professional and pedagogical competence,

$\sum_n$  – total points,

$\sum_m$  – maximum amount of points.

The results were then compared to identify components that would require more attention. Statistical analysis of the results was performed using Microsoft Excel spreadsheets.

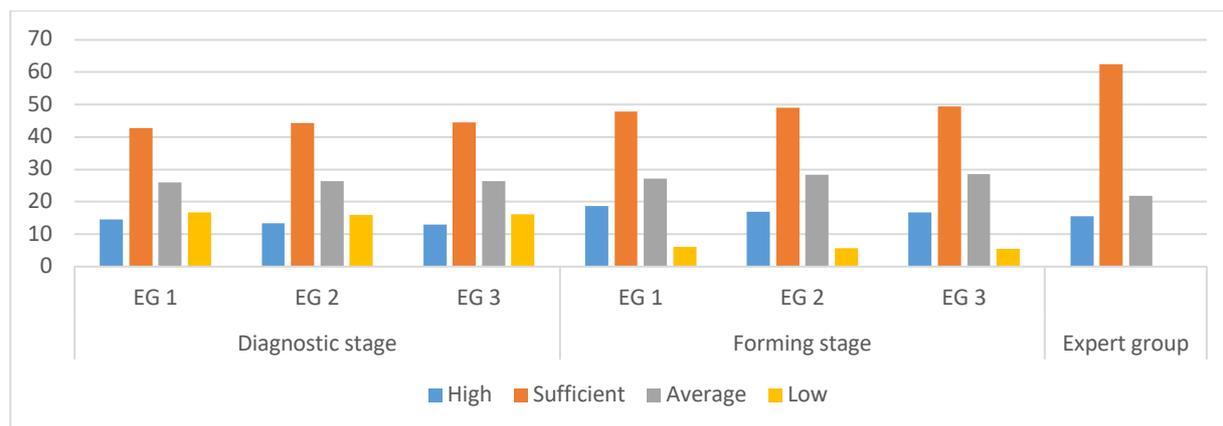
The data in Table 1 show an increase in the level of development of professional and pedagogical competence of primary school teachers in the process of the formative stage of the pedagogical experiment.

**Table 1.** Results of pedagogical diagnostics of assessment of levels of development of professional and pedagogical competence of primary school teachers by diagnostic blocks (final section, in %)

Orientation of professional and pedagogical training of primary school teachers	Levels	EG 1		EG 2		EG 3	
		Diagnostic stage	Forming stage	Diagnostic stage	Diagnostic stage	Diagnostic stage	Diagnostic stage
Theoretical and methodological training	High	14,6	18,8	13,4	17,0	12,9	16,7
	Sufficient	42,7	47,9	44,3	49,1	44,5	49,4
	Average	25,9	27,3	26,4	28,3	26,5	28,5
	Low	16,8	6,0	15,9	5,6	16,1	5,4
Psychological and pedagogical training	High	14,3	20,6	12,4	16,0	11,3	16,0
	Sufficient	47,0	48,2	45,5	48,7	43,9	48,1
	Average	27,1	26,1	26,5	29,9	29,0	30,1
	Low	11,6	5,1	15,6	5,4	15,8	5,8

To construct histograms, we choose indicators of professional and pedagogical competence of primary school teachers at each stage of the study in Table 1. Based on these results, we construct histograms (see Figs. 1 and 2). Thus, the dynamics of the development of levels of professional and pedagogical competence of primary school teachers in accordance with its blocks is clearly visible.

Analysis of the data (see Fig. 1) shows that after the introduction of the corresponding model, primary school teachers in experimental groups have almost no low level of theoretical and methodological training (on average 5,6%). However, the number of teachers with a sufficient level (by 5,0%) and high (by 3,9%) increased.

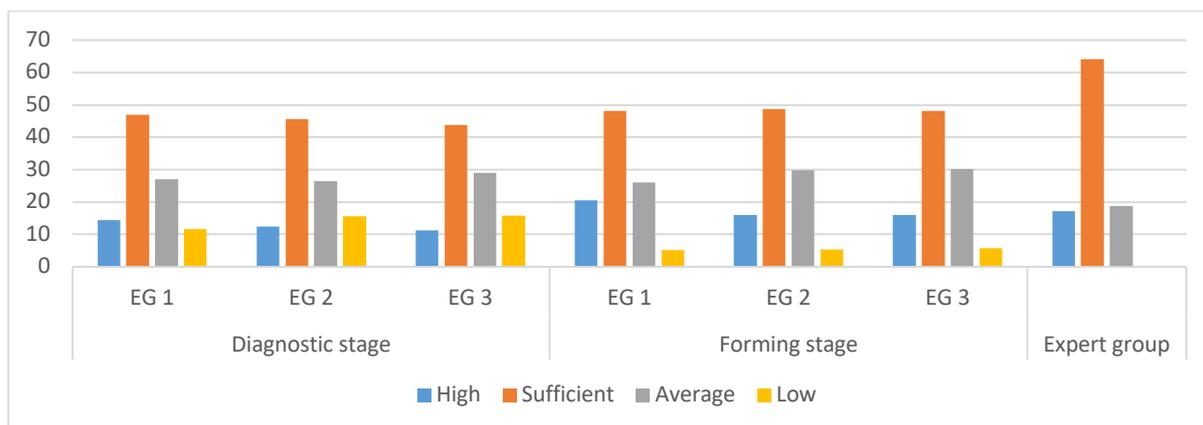


**Figure 1.** Diagram for comparing the levels of development of theoretical and methodological training of primary school teachers (final slice, in%)

These results show that the respondents of the experimental groups have better mastered the theoretical and methodological knowledge, which is stable and comprehensive. In addition, sufficient and intermediate levels of theoretical and methodological training demonstrate that teachers are capable of conscious transformations of professional and theoretical knowledge in accordance with their profession; systematically show purposeful independent cognitive activity, which, in turn, expands the pedagogical potential of specialists, leads to an active search for ways to learn new things, comprehend new information, its theoretical interpretation.

The statistical data of the entrance and exit testing according to the theoretical and methodological block convincingly proved that the system of DL of primary school teachers introduced by us is quite effective. Another indicator of the effectiveness of research and experimental work is the positive changes in the levels of professional and pedagogical competence of primary school teachers in the psychological and pedagogical unit.

As in the study of the theoretical and methodological unit of professional and pedagogical competence of primary school teachers, we observe significant dynamics in the psychological and pedagogical training of respondents in the experimental groups: a high level increased by an average of 5,0%; sufficient – 3,0%. However, the low level is almost absent – 5,4% (see Fig. 2).



**Figure 2.** Diagram for comparing the levels of development of psychological and pedagogical training of primary school teachers (final slice, in %)

The data in Table 1 and Figures 1-2 show the advantage of sufficient and medium levels of professional and pedagogical competence of primary school teachers in all identified blocks, which confirms the effectiveness of the developed system of DL of primary school teachers. Such results allow us to state that EG respondents can much better direct and effectively adapt their knowledge and skills in solving specific psychological and pedagogical tasks based on comparison, analysis, synthesis, generalization, systematization, forecasting. The increase in the indicators of psychological and pedagogical training in EG shows positive changes in the development of professional and pedagogical competence of primary school teachers, their ability to transform professional and life experience at a higher level than reproductive.

The general level of development of professional and pedagogical competence of primary school teachers was calculated as the arithmetic mean of all diagnostic blocks according to formula 2:

$$\Sigma = (a_1 + a_2 + a_3) : n \quad (2)$$

$\Sigma$  – general level,

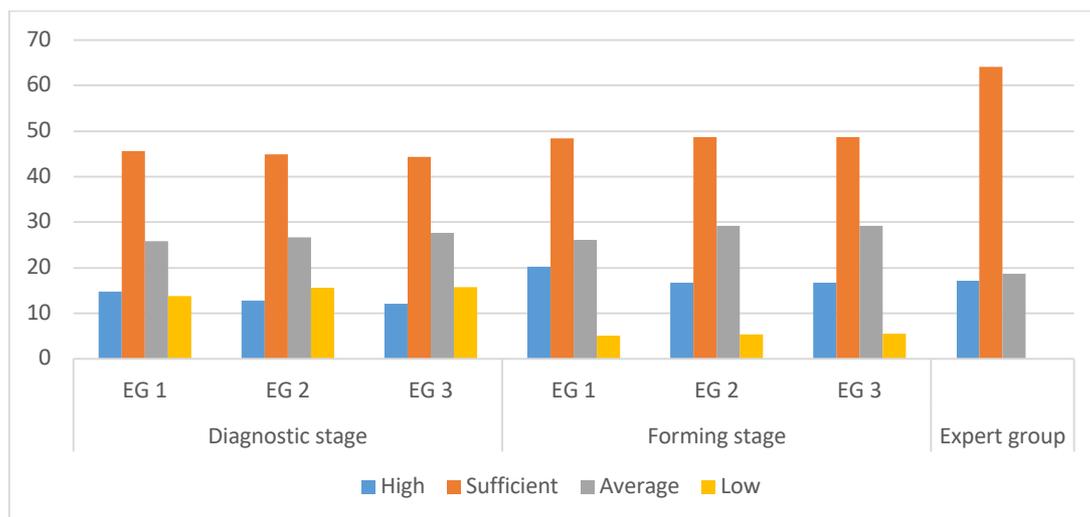
$a$  – the number of participants in the relevant level of the criterion,

$n$  – number of criteria (orientation of professional and pedagogical training of primary school teachers).

The final state of professional and pedagogical competence in experimental groups is determined. The generalized results of the experiment are summarized in table 2, and a graphical interpretation of the results of the molding experiment is presented in Fig. 3.

**Table 2.** The general level of development of professional and pedagogical competence of primary school teachers (final section, in%)

Levels	EG 1		EG 2		EG 3	
	Diagnostic stage	Forming stage	Diagnostic stage	Diagnostic stage	Forming stage	Diagnostic stage
<b>High</b>	14,7	20,3	12,8	16,7	12,2	16,7
<b>Sufficient</b>	45,6	48,5	44,9	48,7	44,4	48,7
<b>Average</b>	26,0	26,1	26,7	29,3	27,6	29,2
<b>Low</b>	13,7	5,1	15,6	5,3	15,8	5,4



**Figure 3.** Diagram on comparing the levels of development of professional and pedagogical competence of primary school teachers (final slice, in%)

The efficiency of the DL system of primary school teachers is evidenced by the efficiency coefficient, which was calculated by formula 3:

$$K = R_E / R_K, \quad (3)$$

$R_E$  – sufficient and high level of development of professional and pedagogical competence of primary school teachers after the experiment (in%);

$R_K$  – sufficient and high level of development of professional and pedagogical competence of primary school teachers before the experiment (in%).

The effectiveness of the developed system can be said in the case when  $K > 1$ .

In our study  $K = 94,3 / 83,7 \approx 10,6$  (theoretical and methodological training);

$K = 94,6 / 85,6 \approx 9,0$  (psychological and pedagogical);

$K = 94,7 / 84,9 \approx 9,8$  (general level of professional and pedagogical competence).

The data show the effectiveness of our system of DL for primary school teachers in experimental groups.

For the final statistical confirmation of the effectiveness of the experiment it is necessary to compare the experimental data of the ascertaining stage with the formative one, calculating Pearson's criterion according to the data for theoretical-methodical, psychological-pedagogical blocks and the general level of professional competence of primary school teachers. The empirical value of the criterion EG 1 is equal to 19,25; 12,07; 16,11 (see Fig. 4); EG 2 – 17,58; 18,78; 18,93 (see Fig. 5); EG 3 – 18,84; 18,39; 19,47 (see Fig. 6). Differences between experimental and control groups can be considered significant. This exceeds the critical value of  $\chi^2_{кр.} = 7,81$  for the degree of freedom  $v = 3$  and  $\alpha = 0,05$ .

Empirical frequency

Theoretical frequency

The critical value of the Pearson test ( $\chi_{crit}^2$ ) at  $v=3$  and  $\alpha=0,05$ :

7,81

Results of pedagogical diagnostics of assessment of levels of development of professional and pedagogical competence of primary school teachers on theoretical and methodical preparation (final slice)	Empirical frequency			Theoretical frequency			
	EG 1 after (absolute amount)	EG 1 before (absolute amount)	Amount	EG 1 AFTER	EG 1 BEFORE	EG 1 AFTER	EG 1 BEFORE
High	62	48	110	55	55	0,890909	0,890909
Sufficient	158	140	298	149	149	0,543624	0,543624
Average	90	87	177	88,5	88,5	0,025424	0,025424
Low	20	55	75	37,5	37,5	8,166667	8,166667
<b>Total</b>	330	330	660	330	330	9,626624	9,626624

The value of Pearson's criterion ( $\chi_{emp}^2$ ): 19,253247

The critical value of the Pearson test ( $\chi_{crit}^2$ ) at  $v=3$  and  $\alpha=0,05$ :

7,81

Results of pedagogical diagnostics of assessment of levels of development of professional and pedagogical competence of primary school teachers on psychological and pedagogical preparation (final slice)	Empirical frequency			Theoretical frequency			
	EG 1 AFTER (absolute amount)	EG 1 before (absolute amount)	Amount	EG 1 AFTER	EG 1 BEFORE	EG 1 AFTER	EG 1 BEFORE
High	68	47	115	57,5	57,5	1,917391	1,917391
Sufficient	159	154	313	156,5	156,5	0,039936	0,039936
Average	86	91	177	88,5	88,5	0,070621	0,070621
Low	17	38	55	27,5	27,5	4,009091	4,009091
<b>Total</b>	330	330	660	330	330	6,037040	6,037040

The value of Pearson's criterion ( $\chi_{emp}^2$ ): 12,074080

The critical value of the Pearson test ( $\chi_{crit}^2$ ) at  $v=3$  and  $\alpha=0,05$ :

7,81

General level of development of professional and pedagogical competence of primary school teachers (final section)	Empirical frequency			Theoretical frequency			
	EG 1 AFTER (absolute amount)	EG 1 before (absolute amount)	Amount	EG 1 AFTER	EG 1 BEFORE	EG 1 AFTER	EG 1 BEFORE
High	67	48	115	57,5	57,5	1,569565	1,569565
Sufficient	160	150	310	155	155	0,161290	0,161290
Average	86	87	173	86,5	86,5	0,002890	0,002890
Low	17	45	62	31	31	6,322581	6,322581
<b>Total</b>	330	330	660	330	330	8,056326	8,056326

The value of Pearson's criterion ( $\chi_{emp}^2$ ): 16,112653

**Figure 4.** Comparison that confirms significant differences in the development of professional and pedagogical competence EG 1

Empirical frequency

Theoretical frequency

The critical value of the Pearson test ( $\chi_{crit}^2$ ) at  $v=3$  and  $\alpha=0,05$ :

7,81

Results of pedagogical diagnostics of assessment of levels of development of professional and pedagogical competence of primary school teachers on theoretical and methodical preparation (final slice)	Empirical frequency			Theoretical frequency			
	EG 1 after (absolute amount)	EG 1 before (absolute amount)	Amount	EG 1 AFTER	EG 1 BEFORE	EG 1 AFTER	EG 1 BEFORE
High	54	42	96	48	48	0,750000	0,750000
Sufficient	156	139	295	147,5	147,5	0,489831	0,489831
Average	90	87	177	88,5	88,5	0,025424	0,025424
Low	18	50	68	34	34	7,529412	7,529412
<b>Total</b>	318	318	636	318	318	8,794666	8,794666

The value of Pearson's criterion ( $\chi_{emp}^2$ ): 17,589332

The critical value of the Pearson test ( $\chi_{crit}^2$ ) at  $v=3$  and  $\alpha=0,05$ :

7,81

Results of pedagogical diagnostics of assessment of levels of development of professional and pedagogical competence of primary school teachers on psychological and pedagogical preparation (final slice)	Empirical frequency			Theoretical frequency			
	EG 1 AFTER (absolute amount)	EG 1 before (absolute amount)	Amount	EG 1 AFTER	EG 1 BEFORE	EG 1 AFTER	EG 1 BEFORE
High	51	39	90	45	45	0,800000	0,800000
Sufficient	155	143	298	149	149	0,241611	0,241611
Average	95	86	181	90,5	90,5	0,223757	0,223757
Low	17	50	67	33,5	33,5	8,126866	8,126866
<b>Total</b>	318	318	636	318	318	9,392233	9,392233

The value of Pearson's criterion ( $\chi_{emp}^2$ ): 18,784467

The critical value of the Pearson test ( $\chi_{crit}^2$ ) at  $v=3$  and  $\alpha=0,05$ :

7,81

General level of development of professional and pedagogical competence of primary school teachers (final section)	Empirical frequency			Theoretical frequency			
	EG 1 AFTER (absolute amount)	EG 1 before (absolute amount)	Amount	EG 1 AFTER	EG 1 BEFORE	EG 1 AFTER	EG 1 BEFORE
High	53	40	93	46,5	46,5	0,908602	0,908602
Sufficient	155	141	296	148	148	0,331081	0,331081
Average	93	87	180	90	90	0,100000	0,100000
Low	17	50	67	33,5	33,5	8,126866	8,126866
<b>Total</b>	318	318	636	318	318	9,466549	9,466549

The value of Pearson's criterion ( $\chi_{emp}^2$ ): 18,933098

**Figure 5.** Comparison that confirms significant differences in the development of professional and pedagogical competence EG 2



levels of readiness of primary school teachers to develop their own professional and pedagogical competence in terms of distance learning. In the experimental groups of primary school teachers in comparison with the control ones, an increase in the indicators of high level of readiness for distance learning in the system of continuing education was observed according to all criteria: motivational-value, cognitive, operational.

The study does not cover all aspects of solving the chosen problem. Prospects for further research are seen in the in-depth study of ways, methods, tools and features of training primary school teachers, teachers of pedagogical universities for professional and pedagogical activities in the field of distance learning teacher-practitioner taking into account the needs of children in moral, mental and physical health.

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