CHAPTER 2
INNOVATIONS IN THE MANAGEMENT OF EDUCATIONAL INSTITUTIONS

IDENTIFICATION AND DISCUSSION OF STRATEGIES FOR THE FUTURE NATURAL SCIENCE TEACHERS' TRAINING TO CONSERVATION ACTIVITY

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Abstract. *The article contains a description of the original experiment conducting in order to identify and justify effective strategies for the future natural science teachers' training to conservation activity. The aim of the paper is experiment conducting in order to identify and justify effective strategies for the future natural science teachers' training to conservation activity. A variety of methods have been used to test the hypothesis of the study. They are: interview, observation, survey, questionnaire survey, mathematical statistics methods for quantitative and qualitative analysis of experimental data, determination of the reliability of results. Systemic and personal-activity approaches are the methodological foundation for the disclosure the process of future natural science teacher training to conservation activity in comprehensive school. Experimental study has been conducted to identify and justify effective strategies for future natural science teacher training to conservation activity. The modern state of ecological education of schoolchildren is considered and analysed by facilities of nature protection activity. Well-proven necessity of perfection and satiation of maintenance of educational process by ecological material and creation of the proper terms for ecological education of schoolchildren. Essence of ecological education of schoolchildren is exposed, that consists in a capture scientific knowledges about an environment, forming of knowledges and abilities of research character, understanding of modern problems of natural environment, forming of ecological consciousness and culture of personality. The row of factors which cause growth of actuality of problem of ecological education of rising generation is transferred. It is found out, that ecological education and education of rising generation is the important problem which requires immediate active actions.*

Keywords: *future teacher training, environmental education, conservation activity, teacher of Natural Sciences.*
JEL Classification: I28, I29
Formulas: 0; fig.: 1; tabl.: 0; bibl.: 8

Introduction. In the conditions of radical changes in secondary and higher levels of education, Ukraine has been faced the problem of improving the University students' training for professional activity that requires theoretical justification and experimental verification, in particular in the process of environmental education. Modern Ukrainian education in the context of European integration requires a new generation of specialists, having a high skill level, creative individuals, able to make decisions deliberately, in particular in nature protection and conservation activity. Nowadays the considerable experience of environmental education researches, covering many aspects of future teachers' professional pedagogical training, including conservation areas, has been accumulated in theory and practice of higher pedagogical education. The problem of ecological education is connected with the conservation activity; environmental work has always been important in the pedagogical science. The idea of forming an ethical relationship towards the natural environment and future teacher training for the conservation activity has its historical roots. It was regarded as an important means of a harmoniously developed personality training, the ensuring its connection with society and environment.

The problem of future teacher training in the process of young generation ecological education is related to the environment preservation and conservation activity, it has always been important in the pedagogical science, explored by modern scholars (Rodygina I., Stryzhak S., Ishchenko V., Rogozina M., Pustovit G., Sovgira S., Lukyanova L.etc.).

In particular, the training of future natural science teacher to self-educational activity is considered in works of Ishchenko V. [1]; scientific and methodological foundations of professional training of future natural science teachers in higher educational institutions are observed in works of Stryzhak S. [7]; didactic foundations of training students – future biology teachers are described in works of Fleshar Y. [8]; pedagogical foundations of self-educational activity of future natural science teachers are represented in works of Rogozina N. [6]. Prokopenko L. and Mitzenko T., investigating the aspects of natural science teacher training, consider it necessary to bring it to the study of native nature and conservation activity with a leading role of field practices [5, p. 33-34].

Researcher Corner T. treats future natural science teacher training as a process of scientific and methodical knowledge assimilation in all aspects of interaction between nature and society, as well as a readiness to address the challenges of education, including ecological culture and education of schoolchildren [3, p.19].Thus, the analysis of the study has shown that under the future natural science teacher training to conservation activity we understand the complex of active practical measures and appropriate actions aimed at the preservation, reproduction and protection of the environment, which are implemented by futnatural science teachers during a certain period and have tangible results.

Aims. The aim of the paper is experiment conducting in order to identify and justify effective strategies for the future natural science teachers' training to conservation activity.

Methods. A variety of methods have been used to test the hypothesis of the study. They are: interview, observation, survey, questionnaire survey, mathematical statistics methods for quantitative and qualitative analysis of experimental data, determination of the reliability of results.

Systemic and personal-activity approaches are the methodological foundation for the disclosure the process of future natural science teacher training to conservation activity in comprehensive school [4, p. 77].

Results. Experimental study has been conducted to identify and justify effective strategies for future natural science teacher training to conservation activity. 1080 students of higher educational establishments took part in the experiment.

Experimental work was carried out in three stages.

During the first stage, the ascertaining one, the state of future natural science teacher training to conservation activity in comprehensive school has been studied. At the second stage – the forming one – the pedagogical conditions of future natural science teachers' training to conservation activity have been examined. The third stage – synthesis. During this stage the analysis, results summarizing and description of the experiment have been done.

At the stage of ascertaining experiment the initial level of future natural science teacher training to conservation activity has been studied; the factors, influencing its preparation, have been identified.

A formative experiment comprised the implementation of organizational and pedagogical conditions; the proof of the substantive content effectiveness of the educational process of future natural science teacher training on the environmental topics; the updating of professional disciplines programs. The methodology of environmental actions conducting has been included in the program of professional practices.

In order to improve pedagogical practices towards environmental protection measures, the guidelines for practice teachers have been developed.

A comparative experiment was conducted to compare the results of theoretical and practical training of students to carry out environmental works during the implementation of different organizational forms and active learning methods in the experimental and control groups. The selection of students in control and experimental groups was conducted for the experiment. They included those who studied at the natural departments, had the same level of general education and approximate age characteristics. There were 20 students in each group.

It has been developed a system of assessing the levels (high, average, low) of future natural science teacher training to conservation activity in comprehensive school. It is characterized by cognitive, motivational-value and practical components. To conduct mathematical processing of the results the grading scale from 2 to 5 points was introduced to assess each task of components. Grade 2 and 3 correspond to low level and range from 1% to 44%, grade 4 – to average level (from 45% to 84%), grade 5 – to high level (from 85% to 100%).

During the ascertaining experiment the tasks for the evaluation of components formation of future natural science teacher training to conservation activity consisted

of questions, tests, problem situations and projects. In the process of theoretical and practical training the results have been generalized on the arithmetic mean indicators in the fields of study: „biology", " geography" and "chemistry" and in the components: cognitive (C), motivational value (MV), practical (P). The indicators are shown in the Table 1.

Table 1. Summarized data of the initiallevel of future natural science teachers'readin essto theoretical and practical training

groups	Theoretical training									Practical training					
	Methodology of students' extracurricular work organization			Special seminar			The technology of conservation activity			Training practice			Productive practice		
	Biol ogy	Geo grap hy	Che mist ry	Biol ogy	Geo grap hy	Che mist ry	Biol ogy	Geo grap hy	Che mist ry	Biol ogy	Geo grap hy	Che mist ry	Biol ogy	Geo grap hy	Che mist ry
c	2,15	2,17	2,12	2,12	2,11	2,12	2,13	2,13	2,15	2,14	2,15	2,13	2,12	2,13	2,13
e	2,15	2,14	2,11	2,12	2,12	2,14	2,13	2,13	2,13	2,13	2,15	2,14	2,13	2,13	2,15

Source: developed by the authors

Analysis of digital data in Table 1 has shown that they almost do not differ, although there are some deviations from the overall picture. As a result of calculations it is established that in the experimental group of future biology teachers the arithmetic average C_e of the conservation activity readiness according to the completed assignments before the studying and improving the content of the discipline "Methodology of students' extracurricular work organization" equals to 2.15 points, which is 43% in the control group: C_c – 2.15 (43%); special seminar: C_e – 2,12 (42,4%); in the control group: C_c –2,12 points (42.4 per cent); the discipline "Technology of the conservation activity" – in the experimental group: C_e – 2.13 points (42,6%), in the control group: C_c –2.13 points (42.6 per cent); before the professional practice in the experimental group: C_e – 2.13 points (42,6%); in the control group: C_c – 2.14 points (42.8 percent); practical training in the experimental group: C_e – 2.13 points (42,6%); in the control group: C_c –2, 12 points (42.4 per cent).Relevant studies were conducted in the process of geography and chemistry teachers' training. Generalized averages of the components and training fields show that the cognitive component of environmental work readiness of future biology teachers in the experimental group equals to 42.6%, in the control group – 42.8%; future geography teachers in the experimental group – 42,4%, in the control group – 42.6%; future chemistry teachers in the experimental group equals to 42.2%, in the control group – 42.6%. The indicators are mainly of a low level.

So, in the control and experimental groups the levels of conservation activity readiness of future natural science teachers were almost the same, with a slight difference.

The average generalized level of readiness for conservation activity on the cognitive component of future biology teachers after the first selection of the ascertaining experiment in the experimental group equals to 42.6%; in future geography teachers– 42,4%, in future chemistry teachers – 42,2%; in the control group: 42,8%; 42,6%; 42,6%, respectively; in future geography teachers – 42,6%, in future

chemistry teachers – 42,4%; in the control group: 43%; 42,4%; 42,6%, respectively; on the motivational-value component for the experimental group of future biology teachers it equals to 42.8 percent; future geography teachers – 42,6%, future chemistry teachers – 42,4%; in the control group: 42,2%; 42,4%; 42,2%, respectively; on the active component for the experimental group of future biology teachers – 42,8%; future geography teachers – 42,6%, the future chemistry teachers – 42,4%; in the control group: 43%; 42,4%; 42,6%, respectively.

When comparing the level of readiness formation in future natural science teachers to conservation activity in the fields of study, it has been found that in the experimental group of future biology teachers it equals to 42,73%± 0,11; in future geography teachers – 42,53%± 0,1, in future chemistry teachers – 42,33± 0,1%; in the control group: 42,67%± 0,12; 42,47%± 0,1; 42,47%± 0,1, respectively. The results demonstrate that in the process of the ascertaining experiment the students, both experimental and control groups of such fields of study as "biology", "geography", "chemistry" showed a low level of readiness formation to conservation activity.

The results of the initial level determination of readiness formation to conservation activity in future natural science teachers have shown a low level. The results are presented in Table 2.

Table 2. Levels of readiness formation for conservation activity in future natural science teachers at the stage of ascertaining experiment

Levels	The control group						The experimental group					
	Biology		Geography		Chemistry		Biology		Geography		Chemistry	
	Abs.	%	Abs.	%	Abs.	%	Abs.	%	Abs.	%	Abs.	%
High	3	0,83	1	0,28	-	-	3	0,83	-		2	0,56
Average	101	28,06	83	23,05	96	26,67	60	16,67	71	19,72	90	25
Low	256	71,11	276	76,67	264	73,33	297	82,5	289	80,28	268	74,44

Source: developed by the authors

The results of the investigation show that the low level of readiness formation to conservation activity in future natural science teachers prevails.

So, the results of the ascertaining experiment have shown the necessity to improve the educational process of future natural science teachers training to environmental work in comprehensive school.

To rationalize the educational process, the program of discipline "Methods of students' extracurricular work organization" has been improved with the implementation the laboratory work "Didactic and methodical foundations of environmental documentation"; special seminar "Methods of the conservation actions"; modification of the educational discipline program "Technology and conservation activity organization"; inclusion of methods of conducting environmental actions to the program of professional practice; the development of guidelines for environmental protection measures during the pedagogical practice. The above mentioned training and methodological support have been integrated in the process of the forming experiment.

The pooled results of the environmental work readiness determination of future natural science teachers have represented the predominance of an average and high

levels in the experimental group and the average one domination – in the control group. The results are shown in Table 3.

Table 3. Levels of conservation activity readiness of future natural science teachers at the stage of the forming experiment

Levels	The control group						The experimental group					
	Biology		Geography		Chemistry		Biology		Geography		Chemistry	
	Abs.	%	Abs.	%	Abs.	%	Abs.	%	Abs.	%	Abs.	%
High	78	21,67	53	14,72	61	16,94	112	31,11	90	25,0	103	28,61
Average	168	46,67	156	43,34	160	44,44	187	51,94	176	48,89	180	50,0
Low	114	31,66	151	41,94	139	38,62	61	16,95	94	26,11	77	21,39

Source: developed by the authors

To generalize the experimental results, the comparison of environmental work readiness indicators of future natural science teachers, obtained in the process of ascertaining and formative experiment, are shown in Table 3.

Table comparative analysis research shows that before the experiment the readiness indicators of future natural science teachers in control and experimental groups during the ascertaining and forming stages of the experiment were almost identical. Improving the educational process by introducing experimental innovations to the pedagogical experiment helps students of the experimental group to reach a high level of readiness to conservation activity in comprehensive school.

Table 4. Comparative efficiency of experimental factors on the results of ascertaining and formative experiments

Field of study	Components	group	Levels of readiness				Gains %
			Before the experiment		After the experiment		
			Arithmetic average $\overline{X}$	%	Arithmetic average $\overline{X}$	%	
Biology	C	e	2,13	42,6	4,29	85,8	43,2
		к	2,14	42,8	3,3	66	23,2
	MV	e	2,14	42,8	4,23	84,6	41,8
		к	2,11	42,2	3,26	65,28	23,08
	P	e	2,14	42,8	4,32	86,36	43,56
		к	2,15	43	3,29	65,88	22,88
Geography	C	e	2,12	42,4	4,15	82,96	40,56
		к	2,13	42,6	3,01	60,24	17,64
	MV	e	2,13	42,6	4,18	83,68	41,08
		к	2,12	42,4	3,08	61,56	19,16
	P	e	2,13	42,6	4,19	83,76	41,16
		к	2,12	42,4	3,17	63,32	20,92
Chemistry	C	e	2,11	42,2	4,22	84,4	42,2
		к	2,13	42,6	3,13	62,52	19,92
	MV	e	2,12	42,4	4,2	84,06	41,66
		к	2,11	42,2	3,15	62,92	20,72
	P	e	2,12	42,4	4,22	84,44	42,04
		к	2,13	42,6	3,22	64,36	21,76

Source: developed by the authors

A review of table 4 shows that during the ascertaining experiment C component of students' conservation activity readiness in comprehensive school was at a low level, ranging from 42.2% in future chemistry teachers to 42.6% in future biology teachers of the experimental group; from 42,6% in future teachers of geography and chemistry to 42.8% in future biology teachers of the control group.

MV_e component was at a low level, ranging from 42.4% in future chemistry teachers to 42.8% in future biology teachers, MV_c, respectively, from 42.2% in future teachers of biology and chemistry to 42.4% in future geography teachers. P_e varies from 42.4% in future chemistry teachers to 42.8% in future biology teachers (low level), P_c is from 42,4% in future geography teachers to 43.0% in future biology teachers (low level).

Discussion. According to the ascertaining experiment results, the difference between the indices of levels of students' readiness formation for the conservation activity conducting in different fields of study, by different components in the experimental and control groups was significant. So, C_e component is within a range of 82,96% in future geography teachers to 85,8% in future biology teachers (high and average levels), C_c – from 60,24% in future geography teachers to 66.0% in future biology teachers (an average level). MV_e – from 83,76% in future geography teachers to 86,36% in future biology teachers (high and average levels), MV_c from 61.56% in future geography teachers to 65,28% in future biology teachers (high and average levels). P_e – 83,76% in future geography teachers to 86,36% in future biology teachers (high and average levels), P_c – from 63.32% in future geography teachers to 65,88% in future biology teachers (high and average levels).

Comparative analysis results of ascertaining and forming experiments have shown that the C component level in experimental group students was changed from low level to high and average ones, C_c – from low to average; MV_e – from low to high and average, MV_c – from low to average; P_e – from low to high and average, P_c – from a low level to average one.

The experimental data are processed according to the methods of Glass J., Stanley J., Lakin G., Marmoza A. It allowed us to compare the levels of future natural science teachers' readiness to conservation activity in comprehensive school before and after the experiment [1].

Table 5. The dynamics of the levels of future natural science teachers' readiness to conservation activity, based on the results of the experiment, %

	Disciplines		Levels		
			high	average	low
The control group	Biology	before	0,83 (9)	28,06 (303)	71,11 (768)
		after	21,67 (234)	46,67 (504)	31,66 (342)
		dynamics	21,04	18,61	39,45
	Geography	before	0,28 (3)	23,05 (249)	76,67 (828)
		after	14,72 (159)	43,34 (468)	41,94 (453)
		dynamics	14,44	20,29	34,73
	Chemistry	before	-	26,67 (288)	73,33 (792)
		after	16,94 (183)	44,44 (480)	38,62 (417)
		dynamics	16,94	17,77	34,71
The experimental group	Biology	before	0,83 (9)	16,67 (180)	82,5 (891)
		after	31,11 (336)	51,94 (561)	16,95 (183)
		dynamics	30,28	35,27	-65,55
	Geography	before	-	19,72 (213)	80,28 (867)
		after	25,0 (270)	48,89 (528)	26,11 (282)
		dynamics	25,0	29,17	-54,17
	Chemistry	before	0,56 (6)	25,0 (270)	74,44 (804)
		after	28,61 (309)	50,0 (540)	21,39 (231)
		dynamics	28,05	25,0	-53,05

Source: developed by the authors

To check the reliability of the results the criterion χ^2 (Chi-square), calculated by the method of Kyverialh A., was used.

In the result of experimental work the experimental group of students have shown higher level of readiness to conservation activity. Thus, after forming experiment conducting a high level of conservation activity readiness in future biology teachers of experimental groups has increased by 30.28 %, an average one – by 35.27 %, a low level decreased by 65.55 %; in future geography teachers – at 25.0%, 29,17 %, and – 54,17 %, respectively; in future chemistry teachers –by 28.05 %, 25.0% and – 53,05 %.

In control groups after the forming experiment conducting, a high level of conservation activity readiness in future biology teachers has increased by 21.04 %, an average one – by 18,61 %, a low level has decreased by 39,45 %; in future geography teachers – at 14,44 %, 20,29 %, –34,73%, respectively; in future chemistry teachers – by 16,94 %, 17,77 %, –34,71 %.

Conclusions. Thus, the strategy of a future natural science teacher training to conservation activity indicates an improvement tendency, shown through the increase of a high level of readiness to the conservation activity in future natural science teachers and low-level reduction that confirms the effectiveness of reasonable and implemented organizational and pedagogical conditions of future natural science teachers' training to the conservation activity implementation in a comprehensive school.

Author contributions. The authors contributed equally.

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