

# Pedagogical Training of Masters in Ecology in Institutions of Higher Education

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**Abstract:** The article substantiates the expediency of pedagogical preparation of masters in ecology for forming in them the readiness for teaching the disciplines of professional direction. The scientific sources review on the problem of concept innovative rethinking of modern ecological education is carried out, students' specific teaching principles and environmentally oriented methods are highlighted. The main result of professional education of ecologists should be the formation of an ecocentric type of consciousness, which will allow them to understand the development of nature and humanity as a process of co-evolution, mutually beneficial unity. The results of researches on the problem of pedagogical preparation of masters with highlighting of its contradictions are generalized. The pedagogical conditions of effective pedagogical preparation of masters-ecologists are substantiated, the content of the special course, developed for deepening the pedagogical component of their professional training, is analyzed. The organization, carrying out and results of the ascertaining and formative stages of the experiment on forming readiness for pedagogical activity of masters in ecology are described. The results obtained testify to the effectiveness of the pedagogical experiment.

**Keywords:** *masters in ecology; ecocentric type of ecological consciousness; pedagogical conditions; special course; pedagogical experiment; readiness for pedagogical activity.*

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## 1. Introduction

Scientists of the world actualize the problem of forming the ecological consciousness of the population, pay attention to the development of conceptual approaches to the conservation of the biosphere and civilization. The path to a high ecological culture of society lies through effective environmental education, which, in higher vocational school, is to solve the global problem of today - promoting human survival as a species of homo sapiens. An important condition for the implementation of this strategy is the professionalism of scientific and pedagogical staff, who provide the process of forming a specialist. Higher education teachers can hold Doctor of Science and Doctor of Phas well as graduate students. The expediency of professional and pedagogical training of students in the process of study in the magistracy is normatively determined by Article 48 of the Law of Ukraine "On Higher Education" (2014). However, the system of professional and pedagogical training does not yet ensure their full readiness for practical pedagogical activity in higher education institutions. They are mainly oriented to practical activities for environmental protection, but do not possess the methodology of environmental educational activities, the necessary methodological tools for choosing the forms of organization of the educational process, methods of training; technologies of individualization of education. The analysis of the results of psychological and pedagogical research shows that the problem of professional and pedagogical training of future specialists in ecology, in particular for the master's degree, was not the subject of recent study.

## 2. Literature Review

Improving higher environmental education is an international problem. It must be seen as a part of a sustainable development strategy. It should be focused on the active interaction of man with nature. Environmental knowledge, based on value orientations, should become the basis of ecological culture and environmental thinking. In the process of preparing the teacher-ecologist, education should be oriented to the students' acquired ecological knowledge to develop into beliefs and become the basis of outlook, and this is possible by using an interdisciplinary approach (Skyba, 2011). In view of the global nature of environmental problems, environmental education is considered as a subject of international cooperation, the main element of which is to study at relevant courses at foreign universities and to obtain a diploma in higher environmental education. The critical state of Ukrainian ecology needs to

expand the range of environmental education: we need to train both environmental educators and environmental management and audit professionals. Environmental education is consisted of three main components: 1. It is about the environment where its goal is environmental awareness; 2. It is in the environment and for its purpose: environmental experience; 3. this is for the environment, the ultimate goal of which is environmental concern (Lazar & Faciu, 2019).

The basis of greening higher education for the training of professionals for sustainable development should be a competent approach that allows for the formation of environmental competence. The core of this key competence is the ecocentric type of environmental consciousness. In environmental education in accordance with the concept of sustainable development, the emphasis is shifted from the study of the nature and foundations of environmental science to the formation of environmental consciousness through the system of environmental values: the desire to protect nature from irrational human activity; are critical of those advances in science and technology used to suppress nature and manipulate man; in a tendency to seek ways out of the ecological crisis, in a sense of unity with nature, refusal to meet pragmatic needs. The importance of the value component in the structure of professional characteristics of ecologists emphasizes H.H. Hlukhova (2008). It is necessary to justify on the basis of the axiology of the concept of student preparation to form it, determine the structure of ecological culture, justify the technology, organizational and pedagogical conditions of its formation (Hlukhova, 2008). Ecological values are a precaution for manifestations of eco-deviant behavior (it is based on traits that harm the natural or anthropogenic environment; eco-deviant - a person with behavior that deviates from common sense).

The environmental educator should be a humanist, who is attained in the process of his professional preparation, when the humanistic orientation has its content, using ecologically oriented methods and techniques, humanizing the relationship between the teacher and the student. For the humanization of environmental education, the structure of a humanist-oriented personality of a specialist ecologist has been substantiated, the components of which are environmental responsibility, new environmental thinking, environmental values. Such a specialist is ready for eco-normative behaviour (Tymchuk & Pohorila, 2019).

Transferring information is just one component of teaching for student-centered teachers. The student-centered approach turns the focus away from the teacher and directs it toward the students and their learning. The teacher takes an interactive approach and continuously strives to ensure

that student understands the course material and the concepts that are taught (Ödalen et al., 2019).

Scientists have proved that the key concept of the problem we are investigating is “environmental consciousness”. It should be the result of students’ environmental education. It is the highest level of mental reflection of the natural, artificial, social environment and its inner world; reflection of place and role of man in ecological world, as well as self-regulation of this reflection. In order to form ecological consciousness, it is important to change students’ perceptions of ecology from external knowledge to internal, personally meaningful: for ecology to become a component of the psychic essence of individual and social consciousness, ecology from an abstract representation must occupy a psychological niche in their consciousness and feelings. In the structure of environmental consciousness there are three components: cognitive (mental reflection of the environment), emotional (attitude to the environment) and connective (strategies and technologies of interaction), which allows to answer the following questions: how a person perceives the environment, how it relates to this environment, how it behaves in the environment. Scientists identify three types of ecological consciousness: anthropocentric, biocentric and ecocentric (Derebo & Yasvin, 2011). The essence of the anthropocentric type of consciousness is that the highest value is the person, the environment is his property; the development of the environment must be subordinate to the development of mankind. Scientists also characterize the ideological principles of the biocentric type of consciousness: nature is of the highest value, humanity must obey it. At the top of the pyramid is a picture of the world - nature, and at its heart - humanity, which directs its potential for service to nature. The purpose of interaction with nature is to preserve its integrity throughout the variety of forms and species, including those that harm both humanity as a whole and the individual. According to this concept, the development of nature is thought of as a process that must be subordinated to the development of mankind. As a genuine alternative to the two extreme types of consciousness is the ecocentric type of eco-consciousness, which is consistent with the concept of sustainable development: the highest value is the harmonious development of man and nature; man is not the owner of nature but one of the members of the natural community; society is not opposed to the world’s natures; they are elements of a single system; the purpose of interaction with nature is the maximum satisfaction of both the needs of man and the entire natural community. The development of nature and humanity is thought of as a process of co-evolution, mutually beneficial unity.

Relevant to our problem are the researches results of scientists who consider that it is possible to accomplish important tasks of improving the quality of professional training of students, including ecologists, by forming a future scientific and pedagogical worker in higher education institutions. The current monograph is Machynska (2013), in which the organizational foundations, content, forms and methods of pedagogical education of masters of non-pedagogical profile are revealed, it is carried out in two directions: in a certain specialty, specialization and by forming readiness for performing the functions of a scientific and pedagogical employee. It is advisable to implement it on the basis of personally oriented, systemic, activity and competence approaches, taking into account motivational-value, professional-pedagogical, professional-personal, managerial and socio-cultural components (Machynska, 2013). As a high school teacher is not only a teacher but also a scientist and educator of student youth, the important principles of master's education are: priority of national and human values, professionalism and objectivity, systematic and continuity, efficiency and effectiveness. The pedagogical potential of undergraduate vocational training is the deployment of a large array of vocational and pedagogical information using a deductive method: from general to specific. Scientists (Hoskinson et al., 2014) offered main recommendations for professional training of ecologists: focus on big ideas and competencies; cultivate productive interactions; think about thinking (metacognition).

Ecology is a complex and dynamic field, and therefore the training of ecology professionals can be based on such specific principles (Knapp & D'Avanzo, 2010): ecological patterns and processes are underpinned by physical laws; ecological systems are open but resources are finite; evolutionary history constrains the ecological present and future; ecological history and context further increase the contingent nature of ecological systems; all aspects of ecology are scale dependent; ecology is the science of interactions and multiple causal factors. If we want our student to become professional ecologist, we need to teach them to think and to act like professionals, and for the students to do so they need to learn, practice and be guided through process (Mtwana Nordlund, 2016).

Undergraduates belong to the category of adults (age of students 21-25 years), so their pedagogical preparation should be carried out on the basis of an andragogical approach taking into account the following principles: self-development, individuality, activity isomorphism of teacher and student, position variability, creation of heuristic environment, reflection, alternatives. It is also advisable to use andragogical methods and technologies: the method of experience analysis, organizational-activity, dialog and interactive

methods (Ohienko, 2015). Blended-learning is very important for teachers' training too. The main signs of this preparation are: trainer-trainee communication is both direct and indirect, mediated; assessment is conducted directly, on-line or in mixed manner (Enache et al., 2019).

The preparation of undergraduates is a multifunctional, open and independent cycle of higher education, the training of which should promote the development of innovative capacity. The result of pedagogical preparation should be readiness for this activity, and therefore it is appropriate to pay attention to the formation of such components of this readiness: goal motivational, semantic, operational, integrative, axiological, outlook (Yavorska, 2013).

Studying the scientific literature in the field of environmental education, observing the process of teaching special disciplines in the specialty "Ecology" allowed us to identify certain contradictions that need to be solved experimentally, namely: between the difficult and tense environmental situation in Ukraine and not quite objective reflection in the system of professional environmental education; between the need of society for scientific-pedagogical workers, capable of preparing students not only as competitive in the domestic and world labor markets of specialists, but also individuals with an ecocentric type of environmental consciousness; between the objective need of HEIs for teachers of professional disciplines specially prepared for scientific and pedagogical activity, and the state of their readiness for it; between the considerable pedagogical potential of innovative and eco-friendly forms and methods of teaching and the real practice of their application in the educational process of preparing masters in ecology.

In view of the above, the problem to which our article is devoted becomes especially topical. The following results can be used in the system of professional preparation of masters-ecologists as teachers of higher education, improvement of professional-pedagogical qualification of ecological disciplines teachers of higher education establishment.

The analysis of scientific sources on the problem of pedagogical preparation of masters in ecology, the presence of contradictions in their professional and pedagogical training give grounds to claim that this problem is insufficiently researched. It is necessary to define and substantiate the pedagogical conditions of teacher-ecologist formation under the conditions of magistracy to overcome these contradictions.

The above analysis of scientific sources testifies to the lack of systematicity in the research of the problem to which the article is devoted; to analyze only some of its aspects. At the same time, there are reasons for

distinguishing two directions of its study. On the one hand, the results of a study on the components of environmental education have been identified, which foresees the need to prepare the future ecologist on the basis of the sustainable development concept where the formation of environmental awareness among students is an important task of professional education; its types are singled out, the formation expediency among young people of its ecocentric type in modern conditions is substantiated. However, the pedagogical conditions of its formation among youth have not been investigated. There is no publication on the special focus of teacher training on the formation of ecologists with this consciousness type, the potential of master's training has not been taken into account. On the other hand, we have documents that regulate the process of student preparation in higher education, requirements for the formation of masters belonging to the category of adults, which substantiates the feasibility of using an andragogical approach; publication of pedagogical content on the use of special pedagogical technologies, since the master's degree is prepared in higher education establishments for innovative professional activity.

Our article, written on the basis of the research results of its authors, will help to combine the two areas of existing research, since we, accepting these results, propose to carry out in the conditions of master's degree-ecologists a specialty at the university and their pedagogical preparation, which in the future can deepen the focus of scientific and pedagogical activities on the formation of a new type ecologists with ecocentric consciousness.

### **3. Methodology**

The main purpose of the research, the results of which are highlighted in our article, is to prepare masters in ecology for pedagogical activity. The publication offers the most significant results obtained experimentally. These are the results of the statement stage of the experiment, which identified the need for pedagogical training of ecologists and the formative stage, which testified the experimental training effectiveness of masters in ecology. The purpose, the corresponding tasks of scientific search have determined the expediency of using scientific methods. A set of interrelated scientific methods (theoretical, empirical and experimental) was used to solve the problems of research related to the pedagogical preparation of masters in ecology. The main focus was on experimental methods. The peculiarity of the study was that its participants were master's students who mastered the specialty "Ecology". All of them

had a diploma in the first (bachelor) level of higher education. According to the Law of Ukraine “On Higher Education” (2014), the master's level corresponds to the eighth level of the National Qualifications Framework and provides for the gaining of advanced theoretical and practical knowledge, skills and practice of the chosen specialty (specialization); general principles of the methodology of scientific and professional activity, other competences sufficient for the effective performance of *innovative* nature tasks of the appropriate level of professional activity (Law of Ukraine “On Higher Education”, 2015). This position of studying in the bachelor's degree of several disciplines of the social-psychological cycle was the ethical basis for involving them (the adult age of students 21-25 years) in the pedagogical experiment. At the same time, the creation of pedagogical conditions, justified by us for the formation of readiness for pedagogical activities of the undergraduate ecologists, contributed to the forming of a psychologically comfortable educational environment for learning. Permission to conduct such training was granted by decisions of the Academic Councils of the Institute of Environmental Safety of the National Aviation University and the Ecological Faculty of the Bila Tserkva National Agrarian University. These institutions of higher education were the experimental base of the study. The current national legislation on higher education stipulates a term of study in the magistracy - 1, 5 years and regulates the number of undergraduates in the academic group (up to 20 people), that is why the experiment lasted for 2016-2019, as it covered two sets of candidates of educational level “masters” (2016-2018, 2017-2019). In general 92 students participated in the experiment. There were 45 people in the experimental groups, and 47 people in the control groups.

The first stage of the study was the conduct of the ascertaining stage of the pedagogical experiment, during which the state of pedagogical preparation of masters in ecology in the conditions of study at a higher education institution was revealed. At this stage surveys, student testing, pedagogical activities were conducted and the method of expert assessments was used. The questionnaire developed by us made it possible to reveal that students consider humanity, tolerance, high morality and communicativeness as professionally important qualities of the teacher; the student needs a thorough knowledge of the subject matter and must use personally-oriented learning technologies. In the teacher's interaction with them the optimal styles are the democratic style and the authoritarian style with the elements of the democratic one. 94% of the respondents indicated the importance of the influence of the personal characteristics of the teacher on the effectiveness of pedagogical activity. 75% of students said that the authority



of a teacher depends on his / her professional competence, ability to find common ground with students, ability to maintain the attention of the audience. 20% of students consider self-esteem and adequacy of their self-esteem as important prerequisites for maintaining the authority of the teacher. 5% of students indicated that the authority of the teacher is given by experience and practical degree. 25% of respondents believe that the basis of pedagogical skills of a teacher of higher education is a thorough knowledge of the profession, the disciplines that teach; 27% - practical experience and communication skills; 13% of respondents believe that the teacher's skill depends on the ability to interest the audience; 5% of students gave the basis of pedagogical skills to self-education. The main reasons for the emergence of communicative barriers in pedagogical communication are the inability of the teacher to establish a parity dialogue with students and to objectively evaluate their achievements. Students were unanimous on the need for special preparation of masters for pedagogical activity. The majority of respondents (85%) of the shortcomings in the training of teachers in the non-pedagogical HEI consider their lack of teaching staff teaching methods and inability to overcome barriers in communication with students. The analysis of the results of the survey shows that the majority of undergraduate students understand the responsibility and importance of the scientific and pedagogical workers role both in the direction of their professional and personal growth. However, the lack of special psychological and pedagogical, methodological knowledge caused the superficiality of the answers regarding the components of the personal and professional portrait of the scientific and pedagogical worker, the role of the student in the educational process, the choice of pedagogically expedient strategies of cooperation with the study objects. In the ascertaining stage of the experiment, 12 teachers took part who provided professional training of students in the specialty "Ecology". The experience of their scientific and pedagogical activity ranged from 2 to 15 years. When working with students, they most often encounter difficulties of a methodological (57%), general pedagogical (63%) and psychological (47%) character, which indicates a low level of psychological and pedagogical knowledge and insufficient methodological preparation for the activity of a scientific and pedagogical worker. Respondents (97%) expressed their opinion on the need to improve the psychological-pedagogical and methodological training of students in HEI. Some of the respondents (48%) suggested to introduce a lesson of pedagogical practice, a special course in order to form readiness for future teaching activity in the curricula of masters. At this stage it was revealed that the disciplines "Pedagogy and Psychology of Higher School", "Teaching

Methods in Higher School”, available in the curricula for the preparation of masters-ecologists, focused only on the formation of the cognitive component of their professional competence, did not contribute to the preparation of students environmental training.

Such results in studying the state of pedagogical preparation of masters in ecology led to the expediency of creating methodological support for the implementation of the formative stage of pedagogical experiment. *The pedagogical conditions for increasing the effectiveness of this training were substantiated:* orientation of the activity of scientific and pedagogical workers to the masters preparation of ecological specialties for pedagogical activity; motivation of masters educational activity to master pedagogical profession; use of principles, teaching methods aimed at the effective preparation of masters-ecologists for pedagogical activity with students of ecological specialties. Methodological *principles* of preparation of masters for ecological-pedagogical activity are distinguished, grounded by scientists in ecological psychopedagogy, psychology and didactics: *the principle of nature-conformity and nature-worthiness* (promotes the development of nature-wise spirituality, which will determine in the further life the guidance of life, moral formation, *the principle of the complexity of stimulating influence* (it is pedagogically expedient to organize influence on the student personality of the whole system’s various stimuli, covering all channels of formation of consciousness: perceptual, cognitive, practical), *the principle of orientation to the actualizing potential of stimuli* (organization of influence on the personality of such stimuli, which actualize certain psychological mechanisms of ecological consciousness formation positive emotional perception of natural objects, identification of various factors contributing to the establishment of parallelism with man); *the principle of heterogeneity of environmental activity* (inclusion of personality in the most diverse activities related to the natural world), *the principle of the formative orientation of environmental activity* (the inclusion of personality in such activities, which “launches” certain mechanisms of environmental consciousness formation), *the principle of individual psychological adequacy of ecological activities* (it is pedagogically appropriate to organize such activities that would meet the specific psychological characteristics of the individual), *the principle of heterogeneity of natural objects:* (organized interaction of personality with various natural objects) (Derebo & Yasvin, 2011). Methods are an important instrument for conducting scientific research, in particular at the formative stage of a pedagogical experiment. The term “method” has different interpretations. As a scientific category, it is a way of achieving a goal, a sort of orderly activity. Methods of studies are methods of well-organized interconnected activity of teacher and student, directed at the solution of

tasks of education, training and development in the process of studies. It is advisable to use *environmentally-friendly teaching methods* to form a scientific-pedagogical worker-ecologist. Some of them have been transformed from well-known teaching methods and designed for the content of environmental training and environmental activities. They will be able to launch a mechanism of positive moral and social behavior, as well as to form a kind of protective mechanism that prevents the deformation of moral values and behavior of both environmental educators and further objects of their educational activities. In accordance with the purpose of our scientific search and using the results of scientific researches of scientists, we carried out the classification of “environmentally-oriented” teaching methods and subsequently used them in the study: 1. *methods of formation of environmental consciousness, thinking, education of environmental values* (demonstration experiment, round table, business game, brainstorming); 2. *methods of formation of subjective attitude to nature* (ecological identification, ecological empathy, ecological reflection); 3. *methods of practical interaction with the natural world* (field practices that combine environmental education and environmental activities; observation in nature is a direct interaction with it, develops a sense of involvement in nature, a sense of its inspiration, which will not allow a person to relate to nature inhumane network; ecological trails (the most diverse in scientific direction - botanical, zoological, geological, as well as complex landscape-ecological); 4. *methods prediction and demonstration of possible consequences of destructive human behavior in the environment* (audiomethods, screening of so-called disaster films, which show the consequences of negligent attitude of people to environmental problems).

*The motivational, cognitive, activity and reflexive criteria for determining the levels of motivational, cognitive, activity and reflexive components* of pedagogical readiness of masters-ecologists were substantiated; pre-professional, elementary level, limited formation, sufficient levels are characterized. These criteria were used in the ascertaining and formative stages of the study.

The homogeneity of EG and CG was determined in relation to the average indicators of the level of readiness for pedagogical activity of undergraduate students in ecology At the ascertaining stage (table 1).

**Table 1.** Distribution of masters in ecology by average levels of readiness for pedagogical activity (before the experiment)

Readiness levels	Experimental group		Control group	
	Number	%	Number	%
pre-professional	12	27,0	11	23,4
elementary	18	40,7	20	42,6
limited formation	10	21,1	12	25,5
sufficient formation	5	11,3	4	8,5
total	45	100	47	100

The hypothesis of the study suggested that the levels of pedagogical readiness of undergraduate students in the ecology of the experimental group will not be significantly different from the control group. Therefore, the alternative hypothesis was the antithesis, according to which the specified levels will differ. Accordingly, Pearson's criterion  $\chi^2$  was calculated to confirm or refute the hypothesis:  $\chi^2 = \sum \frac{(f_o - f_t)^2}{f_t}$  (1) where  $f_o$  are the actual frequencies,  $f_t$  - are the expected frequencies (theoretical) that would occur in the case of independence

To calculate Pearson's  $\chi^2$ , one must know the theoretical (expected) frequencies ( $f_t$ ), which are calculated by the formula:

$$f_t = \frac{\text{Marginal frequency in row} \times \text{marginal frequency in column}}{N}$$

Thus the expected frequency of observations in a cell is equal to the total number of observations in a row (the marginal frequency in a row) multiplied by the total number of observations in a column (the marginal frequency in a column) and divided by the total number of observations in Table N.

For example, the expected frequency of students with a pre-professional level of skill development in the experimental group will be:  $23 \times 45 / 92 = 11$ , with the elementary level =  $38 * 45 / 92 = 19$ , limited formation =  $22 \times 45 / 92 = 11$ , with the level of sufficient formation =  $9 * 45 / 92 = 4$ . We carry out a similar calculation of expected frequencies for all levels of skill formation in students of the control group: pre-professional =  $253 \times 47 / 92 = 132$ , elementary level =  $378 * 47 / 92 = 19$ , limited formation =  $22 \times 47 / 92 = 11$ , sufficient formation =  $9 * 47 / 92 = 5$ , the obtained data are recorded in table 2.

$$\chi^2 = \sum \frac{(f_0 - f_t)^2}{f_t} = \frac{(12 - 11)^2}{12} + \frac{(18 - 19)^2}{18} + \frac{(10 - 11)^2}{10} + \frac{(5 - 4)^2}{5} + \frac{(11 - 12)^2}{11} + \frac{(20 - 19)^2}{20} + \frac{(12 - 11)^2}{12} + \frac{(4 - 5)^2}{4} = 0,083 + 0,055 + 0,1 + 0,2 + 0,09 + 0,05 + 0,083 + 0,25 = 0,911$$

**Table 2.** Actual and expected distribution of undergraduate ecologists with different levels of readiness for pedagogical activity

Readiness levels	Groups of students			
	Experimental group		Control group	
	actual distribution (f <sub>0</sub> )	expected distribution (f <sub>t</sub> )	actual distribution (f <sub>0</sub> )	expected distribution (f <sub>t</sub> )
pre-professional	12	11	11	12
elementary	18	19	20	19
limited formation	10	11	12	11
sufficient formation	5	4	4	5
Total number of students	45	45	47	47

Using the above data, the experimental value of  $\chi^2$  according to the formula 1 was determined.

The freedom degrees number of variation for EG and KG was determined:

$$\nu = (a - 1) \times (b - 1) = (4 - 1) \times (2 - 1) = 3$$

where (a - 1) is the number of rows minus 1; (b - 1) - number of columns minus 1.

The tabular value of  $\chi^2$  for three freedom degrees of variation and a significance level of 0.05 is 7,815. As the actual value of the Pearson test does not exceed the table value, there is every reason to claim that there are no statistically significant differences between EG and CG. Thus, the hypothesis of heterogeneity of the readiness for pedagogical activity of undergraduate students in ecology of EG and CG at the ascertaining stage of pedagogical experiment was proved.

After conducting the formative stage of the pedagogical experiment on forming the readiness for pedagogical activity in future masters of ecology, the Pearson criterion  $\chi^2$  was also used. It confirmed the statistical significance of the positive changes in mastery of this readiness.

#### 4. Results and Discussion

The National Aviation University and BilaTserkva National Agrarian University conducted a formative stage of the experiment, which aimed to carry out pedagogical preparation of masters in ecology on the basis of certain pedagogical conditions and to create a special course and to check its effectiveness during 2016-2019. At this stage, the following tasks were accomplished: the experimental base and participants of the design phase of the experiment were identified; conducted ascending sections to measure the levels of preparedness of masters of the control and experimental groups for pedagogical activity before the experiment began; pedagogical training of students of experimental groups with updating of correspondingly created pedagogical conditions and using the special course "Pedagogical preparation of masters in ecology in institutions of higher education" was carried out; the levels of pedagogical readiness of masters in ecological specialties were measured at the final stage of the forming stage of the experiment. Participants of the experiment were master's students who mastered the specialty "Ecology". 45 undergraduates were enrolled in the experimental groups, in the control groups - 47.

The pedagogical preparation success of masters in ecology is determined by its content. For the content pedagogical focus of the professional training of ecologists in themagistracy conditions, a special course "Pedagogical preparation of masters in ecology in higher education institutions" was developed. It deepened the pedagogical, psychological and methodological components of the experimental training of masters, orienting its to the formation of scientific-pedagogical worker, teacher of special environmental courses. The total amount of the special course was 3 ECTS credits (lectures, practical classes and independent work of students), containing 2 content modules. The main objectives of the special course were: to arouse the students' interest in pedagogical activity, to familiarize them with the formation experience of the national higher education system; to deepen and expand knowledge in pedagogy and psychology; to form organizational skills and to lay the foundations for the development of pedagogical skills; to develop practical skills to find and use effective forms and methods of intensifying the training activities of the subjects of vocational training, to organize training of future ecological specialists on the basic ecological principles and using environmentally oriented teaching methods; to educate students with a responsible attitude to teaching activities, a desire to pursue self-improvement and self-education. The special course developed a system of evaluation of students' academic

achievements, selected cases of pedagogical and environmental content, proposed tasks of quasi-professional and professional content for the skills formation of professional and pedagogical activity (for example, preparation of a synopsis and presentation for conducting a practical lesson in the discipline of “Eco Psychology” on the topic “The concept of environmental consciousness”, in the discipline “Methods of teaching in higher education” on the topic “Methods of teaching ecologists in higher education institutions”; preparation for “micro-teaching” part of the class and its analysis; developing a task for oral and written control of students’ knowledge on a selected topic; preparation for the discussion “Professionally important qualities of a teacher of environmental disciplines”; performing a task on research work: conduct micro-research “Barriers to pedagogical activity”; to lay down the rules of communication of the teacher with students and colleagues and submit them in the form of a presentation. Work with psychodiagnostic techniques was envisaged for self-activity of students by following methods: “Research of empathic tendencies” (by I. Yusupov), “Tendency of the individual to conflict behavior” (K. Thomas’s method, adapted by N. Hryshyna), “Diagnosis of reflection” (by A. Karpov), “General level of communication” (by V. Riakhovskiy).

A diagnostic section of the knowledge and skills of the undergraduate students in pedagogical activity was carried out by means of a comprehensive test before carrying out the pedagogical preparation of students of the experimental groups. It includes various tasks of reproductive and creative types for modeling, design, analysis and comparison, focused on the transfer of knowledge and the formation of skills. The tasks were prepared to test the formation of motivational, cognitive, activity and reflexive components of readiness for pedagogical activity. The analysis of the final results shows that the formation of the motivational component in the students of the control and experimental groups is approximately the same level: 9.33% of EG students and 8.94% of CG students have a pre-professional level; elementary level - EG – 42.22%, CG – 44.26%. A third of respondents have a limited level. Almost the same number of students found a sufficient level: EG-16, 44%, CG-16.60%. In our opinion, this is due to the fact that qualified teachers worked with the students during their studies at the university, so their attitude towards scientific-pedagogical staff and pedagogical activity is quite positive. The test results of the cognitive component of pedagogical activity preparedness testify to approximately the same level in EG and CG. A significant proportion of students - 40.56% of the EG and 40.69% of the CG have elementary level of knowledge; pre-professionall level was found in 29.17%

of EG and 29.79% of CG; the level of limited knowledge development in the EG - 19.17% and in the CG - 19.68%; only 11.11% of EG students and 9.84% of CGs showed sufficient knowledge. The results of the completed tasks indicate that students, having mastered the specialty of ecologist, were not focused on mastering the additional specialty - pedagogical. Regarding the formation of the activity component of readiness for pedagogical activity, we state the following: most students have a pre-professional (EG - 35.19%, CG-34.93%) and elementary (EG-34.93%, CG-39.54%) levels of pedagogical skills. A limited level of these skills was found in 16.30% of EG students and 17.55% of CG students. And only 8.33% of EG students and 7.98% of CG students have sufficient level of pedagogical skills. In our opinion such results are conditioned by the students' lack of ability to distinguish the components of the pedagogical preparation content, to choose pedagogically appropriate forms and methods of teaching. Their ability to use the information resource had medium and high indicators, which is explained by the soundness of teaching the disciplines of information and technological content. Regarding the formation of the reflexive component, it is noted that the largest number is students with elementary level: EG - 40.44%, CG - 40.85%, since most students are not capable of adequate self-esteem, are not ready to accept criticism, set their tasks by reproductive means and are not always responsible for fulfilling their responsibilities. Comparative analysis of the final results of pre-experimental distribution of the students readiness of EG and CG for pedagogical activity gives an opportunity to say that the groups formed in accordance with the requirements of selective observation, found the general characteristics of the general population in groups; the formation of the respective components of the undergraduate readiness for pedagogical activity indicates the heterogeneity of EG and CG (table 1).

The next level of the formative stage was the pedagogical preparation of the undergraduate students who were studying in the experimental groups. Their teaching was binary: on the one hand, they mastered the specialty of ecologist, on the other, they were ready to teach the subjects of environmental direction. To form this type of readiness, they additionally studied the above-mentioned special course; teachers who provided experimental training for undergraduates (previously worked out appropriate methodological recommendations and passed training studies) created pedagogical conditions for purposeful preparation of students for pedagogical activity of environmental orientation. Particular attention was paid to the method of ecologists education, determined by the object of their professional activity and the content of professional training. The



teachers worked on the principles of ecocentric type formation of student ecological consciousness. The focus was on the choice of student-centered educational technologies. In the control groups, the training was carried out using traditional forms of learning organization and methods and aimed at mastering the specialty of the ecologist.

At the final stage of the experiment forming period levels diagnostics of masters preparation in environmental specialties for pedagogical activity was made. Formation of motivational component of readiness was checked by means of front oral and written questioning at practical classes, in the process of performing creative tasks, analysis of pedagogical primary sources and implementation of psychological techniques “Propensity for teaching profession” (by I. Ziaziun), “Valuation studies of values” (by D. Leontiev); questionnaire cards. Formation of cognitive and activity components of readiness was checked by means of a complex control work consisting of 17 tasks. Formation of the reflexive component of readiness was checked with the help of I. Yusupov’s technique “Investigation of empathy tendencies”, V. Karpov’s technique “Diagnosis of reflection”, as well as on the results of creative and individual tasks, participation in the discussion of micro-teaching during practical classes and results speeches. A reflective portfolio method was also used to help us track both quantitative and qualitative performance of their activities. We can see changes and positive dynamics of levels. In the experimental and control groups before the experiment the elementary level (low) (EG - 42,22%, CG - 44,26%) of the *motivational* component of readiness for pedagogical activity prevailed, then after experiment in EG is dominated by the level of limited formation - 52,44% and sufficient - 30,67%; in CG revealed almost the same students number of students with elementary - 38,30% and limited - 36,60% formation levels of the motivational component. In the control group the quantitative indicators changed less significantly. Such differences in the growth of indicators for this component are due to the fact that while teaching a special course at the EG, purposeful work was carried out, which promoted the formation of professional and cognitive interests of masters in teaching activity, self-improvement and self-development, inclined students to search.

The results of the formation of the *cognitive* component in the EG increased significantly. Before the experiment a sufficient level of EG was detected in 11.11% of students, after the experiment - in 22.22%, while in the CG according to the experiment - 9.84% and after - 13.03%. Significantly increased the level of students in the EG, where before the experiment was 19.17%, and after the experiment was 58.06%. In CG the difference between the indicators before and after the experiment at this

level is less noticeable: 19.68% before the start of the experiment and 27.39% after its conduct. After teaching the special course the number of EG students with initial level indicators decreased significantly: before the beginning of the experiment it was 40.56% and after its conduct - 19.17%. Changes in CG at this level are low: 40.69% before the experiment and 38.83% after the experiment. A significant decrease in pre-occupational levels was found in the EG. Before the start of the experiment, the pre-occupational level in EG according to the cognitive criterion was 29.17%, and after the experiment - 0.56%. At the same time, in KG the indicators of pre-professional level did not undergo significant changes: 29.79 - at the beginning and 20, 74% after the experiment. Thus, if the EG before the beginning of the experiment was dominated by the elementary (40.56%) and pre-professional (29.17%) levels, then after the experimental training the indicators changed significantly. Thus, the highest cognitive performance at a limited level was 58.06%, while sufficient was 22.22%. At the same time in CG, where pre-professional (29.79%) and initial (40.69%) levels also prevailed at the beginning of the experiment and slightly different from the pre-experimental state of EG after the experiment in CG, we have the highest initial values (38.83%) and limited (27.39%) levels. In addition, we note a significant difference in the results of the pre-professional level: in the EG - 0.56%, and in the CG - 20.74%. This is explained by the fact that at CG the training was held traditionally, and at the EG different kinds of classes were conducted, students were tasked with creative nature to assimilate knowledge about the activities and characteristics of the personality of the scientific-pedagogical worker and students, knowledge about the content of preparation and organization of the educational process in higher education institutions of environmental orientation and etc. The data obtained indicate the effectiveness of the special training course.

According to the *activity* component, we observe positive dynamics in students of EG and CG. By the beginning of the forming stage of the experiment, the sufficient level of active component formation of the EG was 8.33% and in CG-7.98%, then after the experiment in the EG it increased and amounted to 22.41%, which is significantly higher than the indicators of the sufficient level in CG-12,59%. The quantitative indicator of EG of a limited level qualitatively changed: before the experiment it was found in 16.30% of EG, after the experiment this percentage increased and is 56.48%. In CG the difference between the indicators was only 10.1%: before the experiment - 17.55%, after - 27.66%. Significant decrease in pre-occupational and entry-level indicators in EG students was noted. If before the beginning of the experiment it was 40.19%, then after - 18.33%; 35.19%

of students had a pre-professional level before the experiment, after 2.78%. This tendency indicates the positive changes and acquisition of vocational and pedagogical skills by the students of EG during special course training. In CG positive changes are negligible, since before the experiment in CG the initial level was 39.54%, after - 32.80%; 34,93% of students had pre-professional level before the experiment, and after the experiment their number decreased to 26,95%. Thus, after conducting the formative phase of the experiment, according to the activity criterion, a limited and sufficient level of readiness for pedagogical activity prevails in the EG, and a limited and initial one in the KG.

Dynamics are also observed within the *reflexive* component of undergraduate pedagogical readiness. Before the experiment in the EG the sufficient level was 13.33%, in the CG - 12.34%, after the experiment the indicator of the sufficient level in the EG increased significantly - 26.22%, unlike the CG, where the increase of the indicators is negligible - 15.32%. Restricted indicators have increased significantly. By the beginning of the experiment, they were 24.89% in EG and 26.38% in CG, after - in EG-57.78%, in CG -34.47%. The number of students with an initial level in EG decreased significantly, where before the experiment it was 40.44%, after - 16%. In CG, the difference between the baseline indicators is not so significant - 40.85% - before the experiment and 36.60% - after the experiment; pre-professional level - 20,43% before the experiment and 13, 62% - after the experiment. Attention is drawn to the fact that out of 21.33% of the undergraduate students of pre-professional level before the experiment in EG after the special course training we did not find students of this level by the reflective criterion - 0%. This indicates that EG students have shown responsibility and creativity in their individual and creative tasks, learning to evaluate themselves and their peers, to criticize, to analyze and evaluate the work of others.

Summarized data on levels of masters in ecology the readiness for pedagogical activity after the experiment are presented in table 3.

**Table 3.** Levels of masters in ecology readiness for pedagogical activity after the experiment

Formation levels	Experimental groups (45 people)		Control groups (47 people)	
	number	%	number	%
pre-professional	1	1,33	9	19,36
elementary	8	17,85	17	35,96
limited formation	25	56,44	14	30,21

sufficient formation	11	24,37	7	14,47
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To confirm the statistical significance of the positive changes in mastering the readiness for pedagogical activity of masters in ecology with respect to frequency distributions,  $\chi^2$  Pearson was used, which statistically indicates these changes. A null hypothesis was formulated (empirical distributions are independent - there is no dependence between the implementation of the program of experimental preparation for the pedagogical activity of masters-ecologists and the preparedness in this activity) and an alternative one (empirical distributions are dependent). In order to refute the null hypothesis and thereby confirm the alternative, it was necessary to find out how significant (statistically plausible) differences between the levels of test readiness formation in the EG and CG are found at a significance level of 0.05, the risk of inference is allowed in five cases out of a hundred theoretically possible. The theoretical frequencies ( $\omega$ ) were calculated to test the hypothesis:

$$\omega_1=12/80=0,154; \omega_2=20/80=0,252; \omega_3=33/80=0,413; \omega_4=15/80=0,191$$

Using these coefficients, a table was constructed based on Pearson's  $\chi^2$  criterion:

$$\chi^2 = \frac{(f-f')^2}{f'} = \frac{(3-6)^2}{6} + \frac{(6-10)^2}{10} + \frac{(20-16)^2}{16} + \frac{(10-7)^2}{7} + \frac{(9-6)^2}{6} + \frac{(14-10)^2}{10} + \frac{(13-17)^2}{17} + \frac{(5-8)^2}{8} = 1,5+1,6+1,0+1,286+1,5+1,6+0,941+1,125 = 10,552$$

Therefore, at the final stage of the forming stage of the pedagogical experiment, significant changes in the levels of pedagogical readiness of masters by certain criteria were revealed.

## 5. Conclusions

The results analysis of special studies on the peculiarities of the studentspreparation of different specialties in higher education institutions shows that ecology specialists are in demand in the world and national labor markets, since their professionalism is a determinant of world progress, human survival in the era of natural disasters. The level of their professional dynamism is determined by the quality of specialty training, which in turn is determined by the competence of the professors of the special disciplines. However, the real state of pedagogical provision for the professional education of future environmentalists needs improvement. The optimal

solution to the problem is the pedagogical preparation of the ecologists themselves, who master the educational degree of the master.

The concept of ecologists pedagogical training, in our opinion, should be based on the leading ideas and experience of humane pedagogy and the concepts of modern ecologist formation with an ecocentric type of professional consciousness. This training should be closely linked to the deepening of the environmentalist's speciality, the binary in this process is decisive. We have experimentally proved that pedagogical conditions must be created for the formation of environmental students' readiness for fulfillment of teacher's functions. They are: orientation of activity of scientific and pedagogical workers on preparation of masters in ecology for pedagogical activity; motivation of masters educational activity to master pedagogical profession; use of principles, teaching methods aimed at the effective preparation of masters-ecologists for pedagogical activity with students of ecological specialties. It is expedient to deepen the professional content of training in the magistracy by the pedagogical component of the introduction of the special course "Pedagogical preparation of masters of ecological specialties for pedagogical activity". When organizing experimental training, it is necessary to adhere to methodological principles, specific to environmental education: the principle of nature compliance and nature expediency; the principle of incentive influence comprehensiveness; the principle of heterogeneity of environmental activities; the principle of the formative orientation of environmental activities; the principle of individual psychological adequacy of environmental activities; the principle of natural objects heterogeneity. The most effective in this direction are also ecologically directed methods: methods of ecological consciousness formation, thinking, education of ecological values; methods of forming a subjective attitude to nature; methods of practical interaction with the natural world; methods for predicting and demonstrating the possible consequences of destructive human behavior in the environment.

The analysis of the results of the experimental work showed that the students of the experimental group had significant changes in the levels of readiness for pedagogical activity. In this group the number of students with sufficiently formed (high) level - 24, 37% (before the experiment - 11.3%) and with a degree of limited formation (average) - 56 % (before the experiment - 21%). The number of students with pre-professional (low) level - 17, 85% (before the experiment - 40.7%) and elementary- 1, 33% (before the experiment - 27%) decreased significantly.

We consider the prospect of further research in the use of blended learning in the preparation of masters in ecology.

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