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## Formation of Professional Competencies in Students-ecologists as a Psychological and Pedagogical Problem

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### Abstract

The purpose of the study is to assess the compliance of professional competencies of graduates – environmentalists with the needs of the labor market. The work is based on the results analysis of a sociological survey conducted among graduates and stakeholders. The authors conducted a survey of graduates and their potential employers on their priorities among the professional competencies. The authors have analyzed professional opportunities of graduates-ecologists and the employers' requirements related to their competencies. In this regard, we calculated a rating of competencies significance for employers. The article compares professional expectations of the graduates and their employers. Conclusions. The authors conclude that students attach great importance to competencies, providing opportunities for professional growth, mastery of new technologies and application of innovations. Employers bring teamwork skills, professional skills and knowledge in the professional sphere to the fore.

**Keywords:** ecologist, competence, educational process, profession, polls

### Introduction

Global changes in the world community (rapid technological progress, increasing anthropogenic pressure on the environment, waste accumulation and depletion of resources, etc.) increase the involvement of the Ukrainian society in

global processes, on the one hand, and on the other – exacerbate the need for highly qualified and professionally competent specialists. As Anufrieva rightly notes, education, above all, must meet the interests and demands of the society, and therefore, one of its main tasks is specialists’ training aimed at the needs of today.

Unfortunately, sometimes in modern conditions, the “product” of the pedagogical system is a university graduate endowed with low cognitive and professional motivation, underdeveloped self-control and professional self-awareness as well as a formal attitude to acquiring a profession. This affects the development of personal and professional qualities (key competencies) of the future specialist, indicating the need for their formation during training at the vocational education institutions. Scientific and pedagogical literature pays much attention to the problem of professional competence formation.

### **Formulation of the problem**

Professional competence means the unity of knowledge, skills, abilities, as well as readiness to act in a difficult situation and solve professional problems with a high level of uncertainty. It also includes ability and readiness to achieve a better result of work, attitude to the profession as one of the key personal values (Maksymenko, Titenko, Utkina, Nekos, Shkaruba, 2019). The level of professional competence is determined by the ability of the individual to be realized as a successful and effective specialist.

The concept of competence is broader than knowledge or skills, and implies the ability of a specialist to use acquired knowledge, skills, educational and life experience in a particular situation. We should also mention mastery of methods of finding the necessary information, ability to analyze it, see problems and solutions, self-efficacy, and an understanding of the need to learn throughout life.

Thus, the successful performance of their functional responsibilities involves a set of special knowledge and certain professionally significant personality traits. These components of professional competence are interrelated.

Competence is not specific subject skills, not even abstract mental actions or logical operations, but distinct, vital, necessary for a person of any profession and age.

The level of education, especially in modern conditions, is not determined by the amount of knowledge, their encyclopedic knowledge. From the standpoint of the competency approach, the education level is determined by the ability to solve problems of varying complexity based on available knowledge. The competency approach does not deny the importance of knowledge, but it emphasizes the ability to use it.

The main components of competence are:

1. Knowledge, not just rapidly changing information. Varieties of knowledge to be able to find and direct to their activities.

2. Ability to use this knowledge in a specific situation; understanding how this knowledge can be acquired.

3. Adequate assessment – yourself, the world, your place in the world, specific knowledge, its need for their activities, as well as the method of obtaining or using it.

A number of objective and subjective factors that depend on the society's level of development, the attitude of society to the area of activity under consideration, including the banal one – the level of payment for the future profession, influence the effectiveness of professional competencies formation. The article singles out pedagogical conditions created in a specific educational institution, in a specific specialty and in a professional environment.

The professional competence of the future specialist forms on the basis of theoretical knowledge, practical skills, significant personal qualities and life experience, which ensures his/her readiness to perform professional duties and ensures a high level of self-organization. Many factors determine the meaning of this concept, in particular, general civilization processes, globalization of economic, social and environmental problems, the study of which is one of the main tasks of the EPP (educational and professional program).

Analysis of the pedagogical literature on the essence of environmental competence reveals a fairly wide field of interpretations of this term. Thus, Tytarenko (2007) considers environmental competence of students as “the ability to apply environmental knowledge and experience in professional and life situations guided by the priority of environmental values and non-pragmatic motivation to interact with the environment based on the awareness of personal involvement in environmental problems, responsibility for environmental consequences of their own professional and household activity”.

Traditionally, the learning process in higher education is organized as follows: acquaintance with the theoretical material in lectures, its consolidation during practical or laboratory classes, study and reproduction on the examinations.

Quite often, after graduation, the graduate forgets all the received information because it becomes outdated or does not allow to solve current professional problems – passively acquired knowledge does not give an opportunity to form their own opinions. In addition, training and skilled work are different forms of activity requiring different skills and abilities. For example, a diligent student may not be able to solve creative tasks as required by the conditions of professional activity (Yermakov, 2009).

Taking into account the analysis of theoretical sources and research results, the authors have established that the most important in the individual is the mo-

tivational sphere – a system of value orientations, a set of needs and goals that determine ways to develop and express potential abilities. The issue of motivation is one of the key issues anywhere, and the degree of motivation is considered one of the most important factors of successful activity.

Motivation is one of the fundamental problems studied by psychologists and educators. Its significance relates to the analysis of the individual's activity sources. The complexity and multifaceted nature of the motivation problem determines the multiplicity of approaches to understanding its essence, nature, structure, use of methods of its research.

Employers have recently been involved in the educational process to motivate the students. They participate in the formation of educational and professional programs, lectures and practical classes, including those at their workplaces, holding student internships, as well as training, master classes, etc.

It is important for employers to participate in formulating requirements for learning outcomes for a specific educational program, namely – professional competencies. Students' dreams do not always coincide with the needs of employers. An article is devoted to the study of this problem, the purpose of which is to assess the compliance of professional competencies of graduates – environmentalists with the needs of the labor market. The work is based on the results of a sociological survey conducted among graduates and stakeholders of the Educational and Scientific Institute of Ecology, V.N. Karazin Kharkiv National University (Ukraine).

### **Results of the research**

V.N. Karazin Kharkiv National University has been training ecologists for more than a quarter of a century, majoring in 101 Ecology. Due to the high level of acquired knowledge, graduates are employed in various institutions, enterprises and organizations both in our country and abroad. Training of environmentalists in Ukraine is now carried out in accordance with two standards:

1. Standard of higher education of Ukraine: first (Bachelor's) level, field of knowledge 10 – Natural sciences, specialty 101 – Ecology, which was approved and put into effect by the Order of the Ministry of Education and Science of Ukraine dated 4.10.2018 № 1076;

2. Standard of higher education of Ukraine: second (Master's) level, field of knowledge 10 – Natural sciences, specialty 101 – Ecology, which was approved and put into effect by the Order of the Ministry of Education and Science of Ukraine dated 4.10.2018 № 1066.

All students master one list of disciplines, perform course and qualification work, undergo training and internships, etc. However, the career of each of them develops differently. What does it depend on? Which of the competencies is

a priority for the employer? What competencies do students prioritize? Our research, the results of which formed the basis of this article, is devoted to the search for answers to these questions.

The educational process in a higher education institution aims to train highly qualified specialists. Qualification is the ability to perform the tasks and responsibilities of the relevant work, determined by the name of the profession. To systematize the professions available in Ukraine, the current Classification of Occupations DK 003: 2010 of 01.11.2010 is used, based on the International Standard Classification of Occupations (ISCO 88: International Standard Classification of Occupations/ILO, Geneva), which facilitates the international exchange of professional information .

Ecology is a complex science that is not only based on diverse knowledge, but can also be part of various industries and areas of the economy. Table 1 presents a list of environmental professions according to the current Classification of Occupations.

**Table 1. List of environmental professions (Classifier of professions, 2011)**

<b>code</b>	<b>Professional job title</b>
2148.2	Specialist in geosystem environmental monitoring
2148.2	Specialist in remote sensing and aerospace monitoring
2149.2	Environmental engineer
2149.2	Research engineer
2211.2	Ecologist
2211.2	Ecology expert
2213.1	Junior researcher (agronomy, zootechnics, forestry, nature reserve)
2213.1	Researcher (agronomy, zootechnics, forestry, nature reserve)
2213.1	Researcher-consultant (agronomy, zootechnics, forestry, nature reserve)
2213.2	Engineer for the reproduction of natural ecosystems
2213.2	Engineer for the protection of natural ecosystems
2213.2	Forest protection and conservation engineer
2213.2	Wildlife conservation Engineer
2213.2	Environmental engineer
2213.2	Specialist in environmental education
2359.2	Organizer of extracurricular and out-of-school educational work with children
2411.2	Environmental auditor
2419.2	Specialist in economic modeling of ecological systems
2419.3	Civil service specialist
2442.2	Environmental management specialist
2447.2	Specialist in project and program management in the field of tangible (intangible) production

The study of normative disciplines defined by the standard allows students to form competencies that present them in the labor market. There are 2 groups of competencies: general and professional

**Table 2. General and professional competencies of the master's specialty 101 Ecology (Standard of higher education of Ukraine, 2018)**

<b>General competencies</b>	<b>Professional competencies</b>
Ability to learn and master modern knowledge	Awareness at the level of the latest achievements required for research and/or innovation in the field of ecology, environmental protection and sustainable use of nature.
Ability to make reasonable decisions	Ability to apply interdisciplinary approaches in critical understanding of environmental issues.
Ability to generate new ideas (creativity)	Ability to use the principles, methods and organizational procedures of research and/or innovation.
Ability to develop and manage projects	Ability to apply new approaches to the analysis and prediction of complex phenomena, critical understanding of problems in professional activities.
Ability to communicate in a foreign language	Ability to prove knowledge and own conclusions to specialists and non-specialists.
Ability to search for, process and analyze information from various sources.	Ability to manage the strategic development of the team in the process of carrying out professional activities in the field of ecology, environmental protection and sustainable use of nature.
The ability to motivate people and move towards a common goal	Ability to organize work related to environmental assessment, environmental protection and optimization of nature in conditions of incomplete information and conflicting requirements.
Ability to conduct research at the appropriate level	Ability to self-educate and improve skills based on innovative approaches in the field of ecology, environmental protection and sustainable use of nature.
	Ability to develop environmental projects independently through creative application of existing and generation of new ideas.
	Ability to assess the level of negative impact of natural and anthropogenic environmental hazards on the environment and humans.

Karazin University and Luhansk National Agrarian University conducted a study of the competence expectations of students to find out which of the acquired knowledge the graduates have the highest hopes for. We compared the results with the results regarding the competence expectations of the main employers. The initial precondition of the study is the fact that all masters are already familiar with the work of organizations and institutions focused on the employment of environmentalists. According to the curriculum of the Bachelor's degree's students underwent internships.

The survey is continuous, as it involves the entire staff of full-time masters. Students were asked to choose 5 out of 10 competencies, which, in their opinion, can provide them with successful employment. The same conditions are set for employers.

According to the results of the survey, the authors compiled a rating of general competencies. It turned out that the majority of masters put the ability to communicate in another language (70%) in the first place. In addition, more than 50% of respondents to the main competencies of the general group included: ability to motivate people and move towards a common goal; ability to generate new ideas (creativity).

Professional expectations of masters were assessed in points from 1 to 5 degrees of significance, in their opinion, of each of the competencies in future employment. Table 3 shows the results of the survey: frequency of responses to a particular assessment for each of the criteria.

**Table 3. Assessments of the competencies importance by students**

Competence	Rating				
	5	4	3	2	1
Awareness at the level of the latest achievements required for research and/or innovation in the field of ecology.	6 (30%)	12 (60%)	3 (15%)		
Ability to apply interdisciplinary approaches in critical understanding of environmental issues.	11 (55%)	5 (25%)	4 (20%)		
Ability to use the principles, methods and organizational procedures of research and/or innovation.	6 (30%)	9 (45%)	5 (25%)		
Ability to apply new approaches to the analysis and prediction of complex phenomena, critical understanding of problems in professional activities.	12 (60%)	5 (25%)	3 (15%)		
Ability to prove knowledge and own conclusions to specialists and non-specialists.	8 (40%)	5 (35%)	7 (35%)		
Ability to manage the strategic development of the team in the process of carrying out professional activities in the ecology.	8 (40%)	10 (50%)	2 (10%)		
Ability to organize work related to environmental assessment, environmental protection and optimization of nature, in conditions of incomplete information and conflicting requirements.	6 (30%)	9 (45%)	5 (25%)		
Ability for self-education and training based on innovative approaches in the field of ecology, environmental protection and sustainable use of nature.	6 (30%)	8 (40%)	6 (30%)		
Ability to independently develop environmental projects by creatively applying existing and generating new ideas.	8 (40%)	10 (50%)	2 (10%)		
Ability to assess the level of negative impact of natural and anthropogenic environmental hazards on the environment and humans.	10 (50%)	6 (30%)	4 (20%)		

After statistical processing of the received array of questionnaires, the authors calculated recurrence of the answers of a certain assessment on each of the criteria and rated the growth of the importance of each of the competencies according to the calculated average score (Table 4).

The analysis of the table shows that students prioritize the practical skills of applying knowledge, as well as the personal characteristics of the specialist as an organizer and manager. One should also note that the importance of professional training for all students is rated quite high (over 4.0 points). This can be explained by the confidence of masters in their professional knowledge and placing great hopes on them.

**Table 4. Rating of the average weight of each competence with the students' opinion**

№	Competence	Average score
1.	Ability to apply new approaches to the analysis and prediction of complex phenomena, critical understanding of problems in professional activities.	4.45
2.	Awareness at the level of the latest achievements required for research and/or innovation in the field of ecology, environmental protection and sustainable use of nature.	4.35
3.	Ability to apply interdisciplinary approaches in critical understanding of environmental issues.	4.35
4.	Ability to manage the strategic development of the team in the process of carrying out professional activities in ecology, environmental protection and sustainable use of nature.	4.3
5.	Ability to develop environmental projects independently by creatively applying existing and generating new ideas.	4.3
6.	Ability to assess the level of negative impact of natural and anthropogenic environmental hazards on the environment and humans.	4.3
7.	Ability to use the principles, methods and organizational procedures of research and/or innovation.	4.05
8.	Ability to prove knowledge and own conclusions to specialists and non-specialists.	4.05
9.	Ability to organize work related to environmental assessment, environmental protection and optimization of nature, in conditions of incomplete information and conflicting requirements.	4.05
10.	Ability to self-educate and improve skills based on innovative approaches in the field of ecology, environmental protection and sustainable use of nature.	4

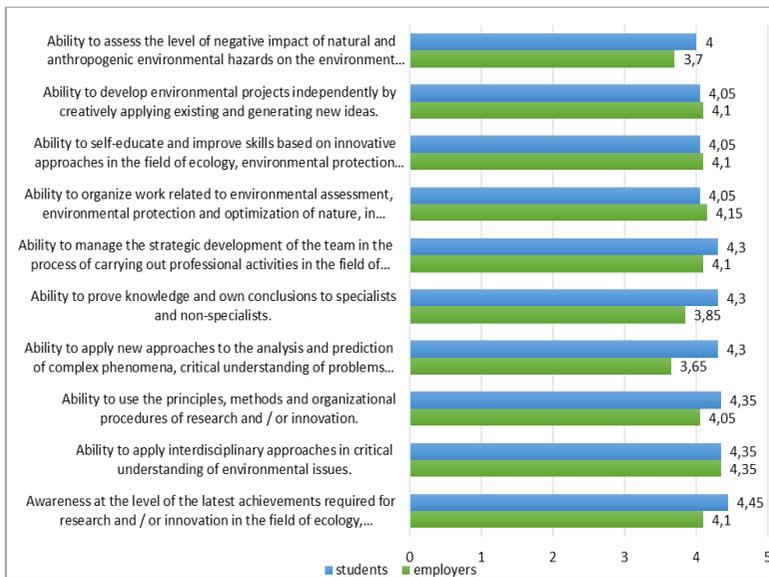
**Table 5. Assessments of competencies importance by employers**

Competence	Rating				
	5	4	3	2	1
Awareness at the level of the latest achievements required for research and/or innovation in ecology and environmental protection.	6 (30%)	10 (50%)	3 (15%)		
Ability to apply interdisciplinary approaches in critical understanding of environmental issues.	11 (55%)	5 (25%)	4 (20%)		
Ability to use the principles, methods and organizational procedures of research and/or innovation.	6 (30%)	9 (45%)	5 (25%)		
Ability to apply new approaches to the analysis and prediction of complex phenomena, critical understanding of problems in professional activities.	5 (25%)	3 (15%)	12 (60%)		
Ability to prove knowledge and own conclusions to specialists and non-specialists.	5 (35%)	7 (35%)	8 (40%)		
Ability to manage the strategic development of the team while carrying out professional activities in the ecology.	10 (50%)	2 (10%)	8 (40%)		
Ability to organize work related to environmental assessment, optimization of nature, in conditions of incomplete information and conflicting requirements.	9 (45%)	5 (25%)	6 (30%)		
Ability to self-educate and improve skills based on innovative approaches in ecology and environmental protection.	8 (40%)	6 (30%)	6 (30%)		
Ability to independently develop environmental projects by creatively applying existing and generating new ideas.	10 (50%)	2 (10%)	8 (40%)		
Ability to assess the level of negative impact of natural and anthropogenic environmental hazards on the environment and humans.	6 (30%)	4 (20%)	10 (50%)		

A similar survey was conducted among employers, the results of which are given in Table 5. Respondents were asked to choose 5 competencies from the above list, which in the opinion of employers, are the most important for the employment of masters. The rating of employers is shown in Table 6.

**Table 6. Rating of the average weight of each competence according to employers**

№	Competence	Average score
1.	Ability to apply interdisciplinary approaches in critical understanding of environmental issues.	4.35
2.	Ability to organize work related to environmental assessment, environmental protection and optimization of nature, in conditions of incomplete information and conflicting requirements.	4.15
3.	Awareness at the level of the latest achievements required for research and/or innovation in the field of ecology.	4.1
4.	Ability to manage the strategic development of the team in the process of carrying out professional activities in the ecology.	4.1
5.	Ability to self-educate and improve skills based on innovative approaches in the field of ecology.	4.1
6.	Ability to develop environmental projects independently by creatively applying existing and generating new ideas.	4.1
7.	Ability to use the principles, methods and organizational procedures of research and/or innovation.	4.05
8.	Ability to prove knowledge and own conclusions to specialists and non-specialists.	3.85
9.	Ability to assess the level of negative impact of natural and anthro-pogenic environmental hazards on the environment and humans.	3.7
10.	Ability to apply new approaches to the analysis and prediction of complex phenomena, critical understanding of problems in professional activities.	3.65



**Graph 1. Comparison of employers “needs and students” expectations**

The analysis of the obtained results showed that the employers rated the ability to apply interdisciplinary approaches in the critical understanding of environmental problems and the ability to organize professional work in conditions of incomplete information and conflicting requirements. Awareness of the latest advances in research and/or innovation in the professional field is also important for practitioners.

Employers rated the lowest the ability to consider professional problems critically. A comparison of graduates “expectations and employers” needs is shown in Graph 1.

## Conclusions

Based on the study, the authors have found that students attach great importance to competencies that give opportunities for professional growth, mastery of new technologies and the application of innovations. Employers bring teamwork skills, professional skills and knowledge in the professional sphere to the fore. The most important general competencies include good command of foreign languages, the ability to motivate people to do work and creativity.

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