



Zhytomyr Ivan Franko State University Journal.  
Pedagogical Sciences. Vol. 3(98)

Вісник Житомирського державного  
університету імені Івана Франка.  
Педагогічні науки. Вип. 3(98)

ISSN (Print): 2663-6387  
ISSN (Online): 2664-0155

UDC 378:57:[37.013-051+005.336.2]  
DOI 10.35433/pedagogy.3(98).2019.22-33

## **SUBSTANTIATION OF THE PROFESSIONAL COMPETENCE STRUCTURE OF BIOLOGY TEACHER AT SPECIALIZED SCHOOL**

**R. K. Melnychenko\***

*The article deals with the concept of professional competence of the Biology teacher at profession-oriented school. On the basis of the analysis of educational and professional programs of Biology teacher training at the institutions of higher education in Ukraine, such components as integral, general and professional are distinguished in the structure of their professional competence. At the intersection of general competences (provide the opportunity for professional pedagogical activity) and professional (reflect the features of the field of Biology, modern methods and teaching Biology techniques), specialized professional competence of the Biology teacher at upper secondary school is formed.*

*According to the author, it is a dynamic integrated system of theoretical knowledge, practical skills, emotions, motives, attitudes, values and experience of the individual, which provides successful implementation of daily professional educational activities in terms of profile organization of training.*

*Motivational-value, cognitive, activity and personality-reflexive components are distinguished, criteria and indicators of their formation are determined in the structure of the professional competence of the teacher at the specialized school.*

*The survey results of Biology teachers of Zhytomyr region, students of bachelor's and master's degrees of higher education, different universities of Ukraine are presented in the paper. The study confirmed the positive perception of the specialized education introduction by the pedagogical community and the lack of internal motivation and willingness of teachers to implement it. The results of the experiment ascertaining stage demonstrated the necessity for continuous professional training of Biology teachers to work in a specialized upper secondary school; introduction of changes in the system of teacher training in institutions of higher and postgraduate pedagogical education. Study of the cognitive and operational activity components of the professional competence of bachelors, masters, and Biology teachers revealed that among all categories of respondents, specialized knowledge about the organization of specialized education in upper secondary school is the worst formed; realization of scientific, research, career guidance work; methods of differentiated teaching in classes of various specializations and profiles. It is difficult to work with creative, gifted students, organize their participation in competitions, contests, research projects. Students, according to self-assessment, consider their own biological, research, methodological knowledge and skills to be formed insufficiently. Moreover, at the levemaster's degree quantity of individuals with sufficient and high level of this component of professional*

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competence increases. Many teachers find it difficult to preserve and maintain their own health; the use of innovative pedagogical techniques, especially information and computer technologies.

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**Key words:** professional competence, content and structure of professional competence of the Biology teacher, professional education programs, bachelors, masters, Biology teachers, specialized education, profession-oriented upper secondary school, continuous teacher training.

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## ОБГРУНТУВАННЯ СТРУКТУРИ ПРОФЕСІЙНОЇ КОМПЕТЕНТНОСТІ ВЧИТЕЛЯ БІОЛОГІЇ ПРОФІЛЬНОЇ ШКОЛИ

**Р. К. Мельниченко**

У статті розглянуто поняття професійної компетентності вчителя біології профільної школи. На основі аналізу освітньо-професійних програм підготовки вчителя біології у закладах вищої освіти України у структурі його професійної компетентності виокремлено такі складові: інтегральна, загальні та фахові. На перетині загальних компетентностей (забезпечують можливість здійснення професійної педагогічної діяльності) і фахових (відображають особливості галузі біології, сучасні методики і технології навчання біології) формується спеціалізована профільно зорієнтована професійна компетентність вчителя біології старшої школи. В авторському розумінні – це динамічна інтегрована система теоретичних знань, практичних умінь і навичок, емоцій, мотивів, ставлень, цінностей та досвіду особистості, що дозволяє успішно здійснювати повсякденну професійну освітню діяльність в умовах профільної організації навчання; є результатом неперервної освіти особистості, її самовдосконалення і саморозвитку; важливою складовою професійної компетентності вчителя. У структурі професійної компетентності вчителя профільної школи виділено мотиваційно-ціннісний, когнітивний, діяльнісний і особистісно-рефлексивний компоненти, визначено критерії і показники їх сформованості.

Подано результати анкетування вчителів біології Житомирської області, студентів бакалаврського та магістерського рівнів вищої освіти, різних університетів України. Дослідження підтвердило позитивне сприйняття педагогічною спільнотою впровадження профільного навчання та недостатню внутрішню мотивацію і готовність вчителів до його здійснення. Результати констатувального етапу експерименту засвідчили необхідність неперервної професійної підготовки вчителів біології до роботи в профільній старшій школі; впровадження змін у систему підготовки вчителів у закладах вищої і післядипломної педагогічної освіти. Дослідження когнітивного і операційно-діяльнісного компонентів професійної компетентності бакалаврів, магістрів і вчителів біології виявило, що найгірше сформованими в усіх категоріях респондентів є спеціальні знання щодо організації профільного навчання у старшій школі; здійснення наукової, дослідницької пошукової, профорієнтаційної роботи; методики диференційованого навчання в класах різного напрямку і профілю. Викликають труднощі уміння працювати з творчими, обдарованими учнями, організація їх участі в олімпіадах, конкурсах, дослідницьких проектах. Студенти, за даними самооцінки, не достатньо сформованими вважають у себе фахові біологічні, дослідницькі, методичні знання та уміння. Причому на рівні магістратури збільшується частка особин із достатнім і високим рівнем цього компоненту професійної компетентності. У значної частини вчителів викликають труднощі уміння зберігати і підтримувати власне здоров'я; застосовувати інноваційні педагогічні технології, особливо – інформаційно-комп'ютерні.

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**Ключові слова:** професійна компетентність, зміст і структура професійної компетентності вчителя, освітні професійні програми, бакалаври, магістри, вчителі біології, профільне навчання, старша профільна школа, неперервна професійна підготовка вчителя.

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### **Introduction of the issue.**

Currently the idea of forming key and professional competences of a person is a priority, which is reflected in a number of legislative documents of many countries around the world, including Ukraine. In the psychological and pedagogical literature, both foreign and domestic, during late 20<sup>th</sup> century – 21<sup>st</sup> century development of the categorical-conceptual apparatus of the competence approach in education has been started. In this context, the essential characteristics of the concepts "competence" and "competency" are established; varieties and structure of competences are studied; the restructuring of the educational process from the point of view of the competence approach as the result of training has been started.

Most researchers define the concept of "*competence*" as a certain integral property of the individual, the ability to perform their professional duties and social functions through a combination of theoretical values, skills, life values, abilities etc. The peculiar feature of the competence is activity character. It is the ability of the individual to make choices in specific life and professional situations. The concept of "*competency*" is narrower and defines a range of powers, a set of interrelated functions and requirements for personality, the integration of which forms the relevant competence.

An exhaustive definition of competence is given in the latest version of the National Qualifications Framework. This concept is interpreted as: "a dynamic combination of knowledge, skills, ways of thinking, values, other personal qualities, which determines the ability of a person to successfully socialize, pursue professional and / or further educational activities" [5].

The TUNING (Tuning Educational Structures in Europe) international project, which began in 2000 and today

covers more than 130 higher education institutions in EU countries, is dedicated to finding convergence points for European universities. This project considers competencies to be specific control points for curriculum development and evaluation of learning outcomes. According to TUNING, competencies include: 1) "*knowledge and understanding*" – theoretical knowledge of a particular academic field, the ability to know and understand; 2) "*how to act knowledge*" – the practical and operational application of knowledge in specific situations; 3) "*how to be knowledge*" – certain values, part of the perception of the surrounding world, coexistence in society with other people [1: 11; 8].

The processes of introducing the ideas of Bologna Declaration into the national educational standart stimulate development and increase the interest in developing a methodology of competency approach. Particularly relevant is the issue of teacher professional competence formation, which is reflected in the law of Ukraine "On Higher Education" and "National Qualifications Framework" [2; 5]. In connection with the reform of the general secondary school, the distinguishing of its senior level as an academic or professional lyceum, the issue of forming the professional competence of a teacher at the specialized school, including a teacher of Biology, remains urgent. The structure, criteria, indicators and ways of improvement the level of the specialized profile-oriented professional competence of the teacher have to be substantiated.

**Current state of the issue.** The problem of the competence approach in education is the subject of scientific study of many researchers. In the USA and Europe it has been covered in the works of such scholars as: S. Adam, D. Blancero, P. Green, W. Hutmacher, W. Houston, R. Howsam, G. Raven,

H. Schaeper, etc. In the countries of CIS, the problem of the competence approach in education is revealed in the works of V. Vvedensky, I. Zymniaya, V. Kraievsky, A. Khutorsky and others. Among domestic scientists, the problem of the competence approach has been the subject of scientific research by O. Antonova, N. Bibik, O. Dubaseniuk, V. Kovalchuk, S. Lisova, O. Pometun, S. Sysoieva and others.

Most scholars point out three levels of competence: 1) the key competences, which are the basic for social adaptation and mastery of any profession, are characterized by multifunctionality; 2) sectoral, general or professional competences inherent in a particular profession or educational field; 3) subject or special competences, reflecting the specifics of a particular subject area of activity, are formed during the study of certain educational subjects in educational institutions [1; 3].

**The outline of unresolved issues brought up in the article.** The concept of professional competence of the teacher, including the teacher of biology is of great interest to the teaching community. Thus, the formation of the professional competence of a Biology teacher is studied in a monograph by Y. Shapran [9]. Natural sciences teachers training to specialized education of upper secondary school students in the system of advanced training has become the subject of scientific research by I. Sotnichenko [7], and in the conditions of the pedagogical university – V. Onipko [4].

The concept of teacher's professional competence is of great interest to the teaching community. Notwithstanding the importance of implementing a competent approach to teacher training, there is no State Higher Education in the field of knowledge 01 "Education / Pedagogy" in Ukraine today, as well as field standards for the speciality 014 "Secondary education",

including specialization 014.05 "Secondary education (Biology)". Even more acute, in connection with the reform of the school in Ukraine, is the question of the professional competence of the teacher, who performs professional activity in the conditions of profile organization of education at the senior level of secondary education.

Therefore, any research in this field is relevant and meets the requirements of today.

**Aim of research** is to clarify the concept and substantiation of the structure of professional competence of the Biology teacher at the specialized upper secondary school.

**Results and discussion.** As mentioned above, today there is no State Standard of Pedagogical Education in Ukraine. Universities independently develop educational and professional programs (EPPs) for various specialties, creating project teams of qualified professionals. Every program is reviewed by external stakeholders, approved by the Scientific and Methodological Council of the institutions of higher education, licensed and externally accredited. The EPP contains a description of the program profile, which provides general information about the field of knowledge, level of education, educational and vocational qualifications, learning goals, methods and techniques, academic rights and employment of graduates, the form of applicants certification for higher education, as well as program competencies and program outputs.

This is completely correlated with European educational programs. The document "Tuning Educational Structures in Europe. A Tuning Guide to Formulating Degree Program Profiles" similarly describes the structure of the program profile, as well as a clear distinction between subject competences and learning outcomes "A *competence* is a quality, ability, capacity

or skill that is developed by that is developed by and that belongs to the student", "A *learning outcome* is a measurable result of a learning experience which allows us to ascertain to which extend/level/standard a competence has been formed or enhanced" [8: 21].

An interesting study of the professional competence of teachers of mathematics and science COACTIV was carried out by a team of German researchers (M. Kunter, Th. Kleickmann, U. Klusmann, D. Richter). According to the scholars, the notion of a teacher's professional competence includes a diverse set of abilities (knowledge, skills, beliefs, motivational and self-regulating personality traits) that determine a teacher's performance of the professional tasks. The model of teacher's professional competence development offered by the German researchers is based on two grounds: 1) the content of training (depends on the education system, individual training, features of the educational institution, etc.); 2) individual personality (cognitive abilities, character, temperament, motivation, etc.). The formation and development of the professional competence of teachers of mathematics and natural sciences is significantly influenced by professional practice – group activity, cooperation, work experience internship. According to M. Kunter, the results of professional competence performance by students are the study of subject material, motivational and emotional development. Teacher's career growth, professional well-being, mandatory use of innovations, development of professionalism demonstrate teacher's professional competence [3: 63-67].

We have analyzed the educational and professional programs for the Biology teacher preparation at the bachelor's and master's degrees of higher education in Ukraine, which are

situated on the official sites of a number of HEIs (Zhytomyr Ivan Franko State University, Kherson State University, Ternopil Volodymyr Hnatiuk Pedagogical University and Volodymyr Vynnychenko Central Ukrainian State Pedagogical University, Kamianets-Podilskyi National Ivan Ogiyenko University, Bohdan Khmelnytsky Melitopol State Pedagogical University, V. N. Karazin Kharkiv National University etc.), which have speciality "Secondary Education (Biology)".

It can be stated that in the structure of the Biology teacher professional competence, including the profession-oriented upper secondary school, we can distinguish the following components:

1) *integral competence* – the ability to solve complex problems in the fields of secondary education and Biology, which involves carrying out research and innovation activities, rethinking existing and creating new holistic knowledge, practical implementation of the results obtained, characterized by the complexity and variability of the pedagogical process organization at the secondary school;

2) *general competences* are based on a common understanding of the subject area and provide the opportunity for professional activity. According to the education programs for a Biology teacher training, general competences are based on key competences, taking into account the specificity of the pedagogical activity.

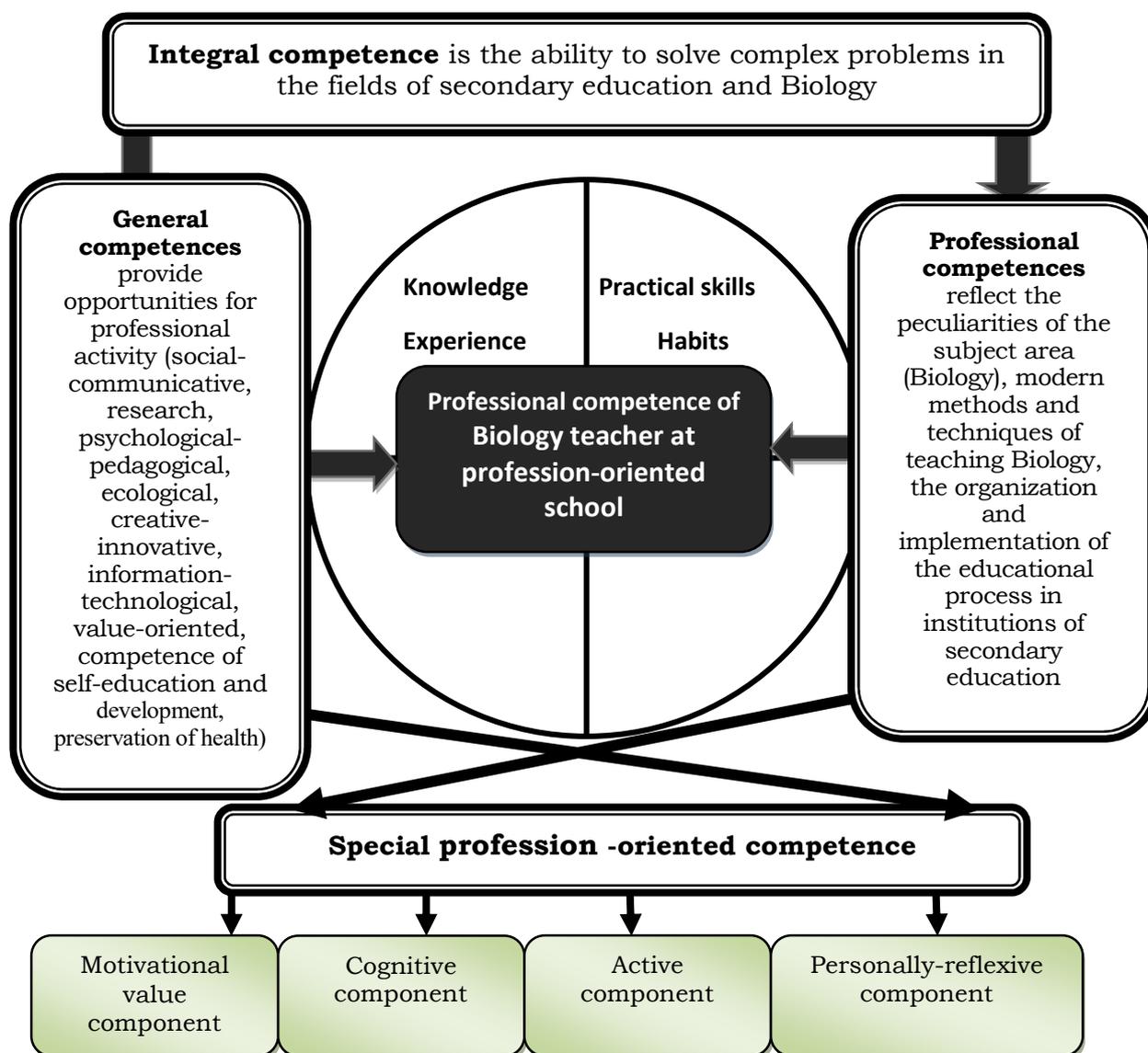
3) *professional competences* are a number of special competences reflecting the peculiarities of the subject area (Biology and related natural sciences), as well as modern methods and techniques of teaching Biology, organization and implementation of educational process in the secondary education institutions.

At the intersection of professional and general competencies, in our opinion, *specialized professional*

*oriented competence* is formed. In the context of our research, it is a dynamic integrated system of theoretical knowledge, practical skills, emotions, motives, attitudes, values and experience of the individual, which allow successful implementation of daily professional educational activities in the conditions of profile organization of training; it is the result of continuous education of the individual, their self-improvement and self-development, and an important component of a teacher's professional competence.

The content and structure of professional competence of the Biology teacher in the profession-oriented school is demonstrated in pic. 1.

In our opinion, motivational-value, cognitive, active and personality-reflexive components can be distinguished in the professional competence of the teacher at profession-oriented school structure. The criteria and indicators of the formation of these components are given in tab. 1.



Picture 1. Structure of professional competence of Biology teacher at profession-oriented school

Table 1

**Criteria and indicators for assessing the specialized profession-oriented professional competence of the Biology teacher**

Components of competence	Formation criteria	Indicators
<b>Motivational value component</b>	<p><b>Motivational and axiological:</b></p> <ul style="list-style-type: none"> <li>✓ The formation level of professionally important values, interests and motives for improving one's educational level and professional pedagogical activity;</li> <li>✓ Positive attitude, interest in the process of profiling, desire to bring it to life;</li> <li>✓ Focus on professional self improvement and self-development.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Awareness of the importance and public significance of the teaching profession;</li> <li>✓ Existence of intrinsic motives and aspirations to form your own professional competence while studying at Higher Education Institutions,</li> <li>✓ The desire to achieve a high level of pedagogical skills during professional activity;</li> <li>✓ Desire to work in specialized biological classes;</li> <li>✓ Aiming at self-development and creativity.</li> </ul>
<b>Cognitive component</b>	<p><b>Knowledgeable:</b></p> <p>Adequate level of formation of the necessary knowledge for the work of the Biology teacher at the specialist school, namely:</p> <ul style="list-style-type: none"> <li>✓ professional biological and natural knowledge;</li> <li>✓ psychological and pedagogical knowledge;</li> <li>✓ methodological knowledge;</li> <li>✓ special knowledge</li> </ul>	<ul style="list-style-type: none"> <li>✓ Completeness, strength, systematicity, integrity of professional natural, methodical, psychological-pedagogical and special knowledge, their practical professional orientation;</li> <li>✓ Awareness of the content, forms, methods, techniques of work of the Biology teacher in terms of profile organization of education</li> </ul>
<b>Active component</b>	<p><b>Operational and behavioral:</b></p> <p>Sufficient level of professional skills formation to carry out pedagogical activity in the conditions of profile organization of training.</p>	<p>Availability, productivity, systematic gnostic, communicative, methodological and technological, organizational, research, design, health preserving, constructive, psychologically-reflexive, vocational guidance skills</p>

<b>Personally- reflexive</b>	<b>Personal:</b> The level of knowledge formation about one's self, preservation of one's physical and mental health; availability of adequate self-esteem, ability to self-control, self-organization, self-development, correction of own activity.	Availability, completeness, systematic knowledge of personal development of professionally important qualities, preservation of own health, adaptability to professional activity in a profession-oriented upper secondary school.
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In order to diagnose the level of the Biology teachers professional competence formation, their readiness to carry out profile education of high school students; outlining the most important problems in the practical implementation of this area of education, during 2014-2019 the author conducted a survey of 182 teachers of Zhytomyr region, 380 bachelor students of 11 higher education institutions of Ukraine and 76 undergraduates of Zhytomyr State University full- and part-time modes of education, future Biology teachers.

It should be noted that the overwhelming majority of practitioners (85.4 %) supports the idea of profile education, although many point out that earlier differentiation of primary school education (32.5 %) is advisable. Some respondents (8.5 %) believe that profile education puts children at a disadvantage when drawing up EITs, especially in rural areas; about 6.2 % consider profile training a superfluous burden on teachers and students.

Despite such a high level of support in the *whole the idea of profiling*, only 65.4 % of teachers, 58.5 % of bachelors and 74.2 % of undergraduates desire to work in profile classes. The motivation of these respondents is self-realization in the profession; the ability to work creatively; to see the result of their work in the students' successes. According to self-esteem data, only 12.8 % of teachers are fully and 48.2 % partially ready to work in a specialized upper secondary school, especially in

the biological profile classes. Among students and undergraduates, more than half of respondents do not feel internally prepared for this type of professional activity.

Among the *reasons* for reluctance to work in a specialized school, teachers noted the imperfection, often even the absence of textbooks and training programs (18.2 %); it takes a lot of time for self-preparation and is not stimulated financially and morally (5.7 %); pressure from the management on the formal results of work – winners of subject competitions, contests of scientific works (3.5 %), 2.7 % of teachers do not see for themselves the difference between the specialized and ordinary class. Among the students surveyed, 13.9% do not want to go to school at all; 7.7 – see no difference between specialized and ordinary class; 5.8 – fear of responsibility to parents and students, and 2.5 – pressure from management on formal results of work; 4.2% of negative responses are due to lack of financial incentive and time spent preparing for lessons.

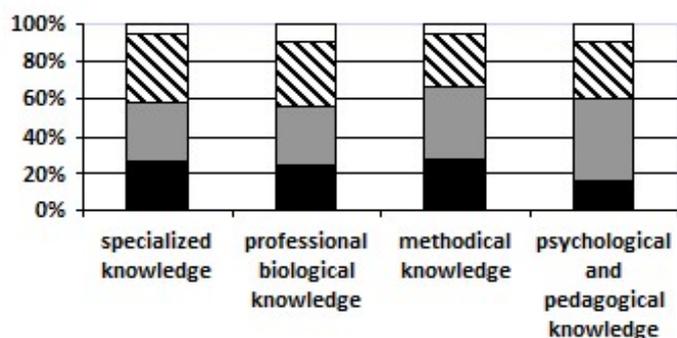
Moreover, 42 % of teachers (graduates from 10 different educational institutions of Ukraine) and 64% of students believe that in order to introduce profile education in upper secondary school, it is necessary to change the system of training future teachers at universities. Among the ways that will help increase the readiness of pedagogical specialties graduates to work in terms of education profiling, the most effective (on a 5-

point scale) respondents consider to be: 1) increase the duration of pedagogical practices in school, including in specialized Biology classes (4,58 points); 2) introduction of a special course that would introduce senior students with the features of profile education, methods of work in the senior profile classes, the experience of best practitioners (4,55); 3) application of innovative techniques at universities and increasing requirements for students and the level of teaching of biological and methodological disciplines (by 4,15 points).

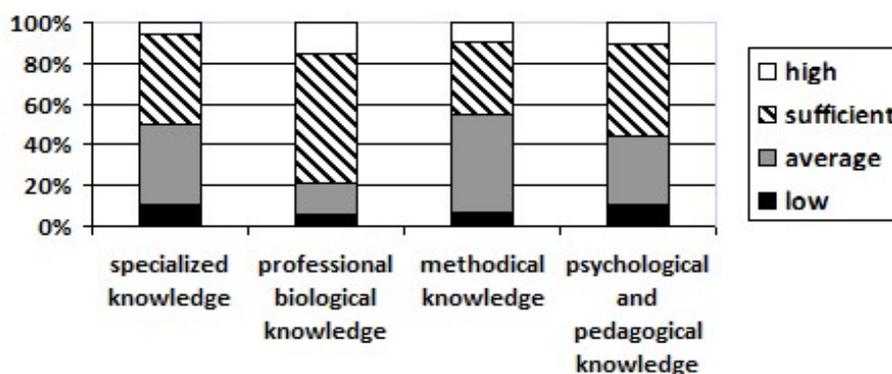
We asked the respondents to evaluate the importance of the different knowledge and skills required by the

Biology teacher of the profession-oriented school and their self-assessment. The results of the analysis of the knowledge component formation of the profile-oriented professional competence of all categories of respondents are shown in pic. 2, 3.

The most problematic for all groups of respondents were the special knowledge of the basic tasks, principles, directions, forms of realization of profiling training, legislative and regulatory base of its organization, knowledge of principles and methods of realization of scientific, research, search work with students; as well as knowledge of the psychology of giftedness and creativity.



**A, BACHELORS**



**B, MASTERS**

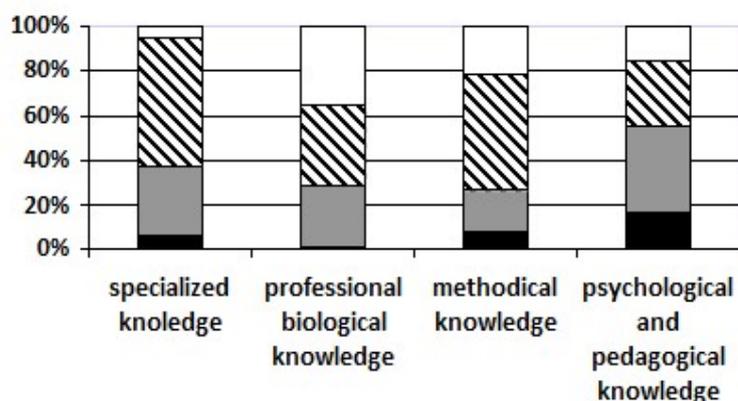
Picture 2. The level of knowledge formation required for the Biology teacher at the profession-oriented school according to the self-assessment of bachelors (A) and masters (B)

Bachelors, according to their self-esteem, almost 60% of respondents at the average and low levels have formed professional, special, methodological and psychological-pedagogical knowledge. At the same time, at the level of the magistracy there is a clear tendency to increase the proportion of individuals with sufficient and high level of them (pic. 2, A, B).

Among the skills that are particularly problematic are: choosing the best forms, methods and means of teaching according to the topic of the lesson and its place in the training course; mastery of teaching methods of the subject according to the study profile; organization of differentiated work within the class; implementation of educational and research work with students; organization of students'

independent work; use of innovative educational techniques. The well-educated students find themselves able to find the information they need, use a computer and variety of multimedia and technical training tools. Undergraduates, in comparison with bachelors, have a better appreciation of their methodological, research, communication and reflective skills, and it is obviously related to greater social and professional pedagogical experience (pic. 2 B).

Biology teachers rated the formation of their own professional and methodological knowledge as the most important, which is obviously related to their professional experience in school, including in the upper secondary school classes (pic. 3).



### **TEACHERS**

Picture 3. The level of knowledge formation required for the Biology teacher at the profession-oriented school according to the self-assessment of Biology teachers

Most of the teachers were challenged by differentiated teaching methods according to the abilities, professional intentions and interests of students of different profiles; application of ICT training technologies; ability to carry out vocational guidance; to manage students' research work, to organize them for participation in competitions, contests of scientific

works and projects; ability to save and maintain their own health; prevent mental overload, relieve anxiety symptoms.

Conclusions and research perspectives. Thus, our study confirmed the interest of the teaching community in the introduction of profile education at the senior level of secondary education. It demonstrated

the need for systematic continuing professional training of Biology teachers to work in a profession-oriented school; revealed insufficiently formed indicators of their professional competence. The professionally oriented professional competence of the Biology teacher is an integrated set of their theoretical knowledge, practical skills, values, motives, attitudes, and personal experience, which allows carry out professional activity independently and qualitatively in the conditions of profile organization of training. It is necessary to increase its level at all stages of higher education (Bachelor's and Master's degrees), as well as during postgraduate pedagogical education, formal, non-formal and self-educational activities.

Among the skills that are particularly problematic are: choosing the best forms, methods and means of teaching according to the topic of the lesson and its place in the training course; mastery of teaching methods of the subject according to the study profile; organization of differentiated work within the class; implementation of educational and research work with students; organization of students' independent work; use of innovative educational techniques. The well-educated students find themselves able to find the information they need, use a computer and variety of multimedia and technical training tools. Undergraduates, in comparison with bachelors, have a better appreciation of their methodological, research, communication and reflective skills, and it is obviously related to greater social and professional pedagogical experience.

Further research is aimed at the study of the content, methods and techniques of Biology teacher training at specialized school in higher and postgraduate institutions. It is essential to develop professional education

programs for the training of such professionals.

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Received: August 09, 2019

Accepted: September 11, 2019