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$$\frac{R^2}{2} \frac{1}{r^2} = \frac{8\pi G}{c^4} \frac{T_{\mu\nu}}{r^2}$$
$$\Omega = 4 \left( \frac{1+2A^2}{(1-2A^2)^2 - A^2 r^2} \right) = A(1+4A^2 - 2A^2 r^2)$$
$$\frac{R^2}{2} \frac{1}{r^2} = \Omega^2 \wedge \theta^2 = \theta^2 \wedge \theta^2 = \frac{a'}{ab} \frac{b+\pi r}{7b^2} \theta^2 \wedge \theta^2$$
$$\left( \frac{V_r}{r} \right)^2 + \left( \frac{\partial V_z}{\partial z} \right)^2 + \left( \frac{\partial V_r}{\partial r} + \frac{\partial V_z}{\partial r} \right)^2 + \left( \frac{\partial V_\phi}{\partial r} - \frac{V_\phi}{r} \right)^2 + \left( \frac{\partial V_\phi}{\partial r} - \frac{V_\phi}{r} \right)^2$$
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# TERMINOLOGY WORK OF FUTURE BIOLOGY TEACHERS DURING THE FIELD-BASED TRAINING IN BOTANY

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## **Abstract**

This paper focuses on problems of terminology work during the field-based training in botany and examines means and exercises of forming professional and terminological competence of future biology teachers. It is shown that improving the level of professional and terminological competence of students provides the background to better scientific awareness of students and contributes to improvement of the quality of academic activity during the professional practice.

Biology is based on the results of field research and discoveries. Therefore training that occurs in a field setting is a powerful experience that promotes the development of creative teachers, enhances environmental literacy, and instills ecological responsibility. The content literacy is an important component of studies. In order to improve literacy, it is primarily necessary to form an active professional vocabulary.

**Keywords:** terminology, professional and terminological competence, field-based training in botany, future biology teacher.

## **Introduction**

The main guideline of modern higher education is the search for methodological ways of organizing the educational process of training a competent specialist. The future biology teacher should optimally organize his professional and communicative activities. A basis for this is proficiency in professional terminology, which is one of the indicators of understanding professional and subject concepts, the level of culture of professional communication.

That is why mastering professional terminology is crucial to the formation of professional and terminological competence of the future specialist and one of the important problems of modern professional education.

The relevance of this study is due to the lack of experience that would identify the specificity and system of terminology work during the field-based training in botany.

## **Statement of the problem**

Scientific terminology is the highest manifestation of human thought, the basic structural element of improving and standardizing the language of a particular industry.

Terminology is a general word for the group of specialized words or meanings relating to a particular field, and also the study of such terms and their use [9]. Terms are words and compound words or multi-word expressions that in specific contexts are given specific meanings – these may deviate from the meanings the same words have in other contexts and in everyday language [6]. A definition is a statement of the meaning of a term (a word, phrase, or other set of symbols). Terms are used in the knowledge and assimilation of scientific and professional objects and relations between them.

In the analysis of terms, the priority is given to the structural and cognitive aspect, mastering the term elements. Since biological terminology has Latin origin, we consider it necessary to study the semantics and the etymology of the terminological elements of Greek and Latin origin.

An individual active terminological vocabulary of a future specialist is the basis of his professional and terminological competence. It is formed as a result of mastering the subordinated system of term elements.

Professional and terminological competence is a formed capacity to use professional terms correctly and precisely during the professional activity; acquired skills of oral and written speech with use of experience gained during the studies of professional disciplines.

**The purpose of the article** is to reveal the essence, conditions and specifics of the terminology work of future biology teachers during the field-based training in botany.

The purpose is addressing two tasks concerning the field-based training in biology (botany): 1. The role of field-based experience is important to consolidation of biological terminology. 2. How the fieldwork may enhance the students proficiency in biological terminology. Here, we explore each of these questions and offer suggestions about the ways to ensure that future generations of biologists will be able to master the terminology knowledge that can be acquired in field settings.

### **Summary of the Research**

The professional activity of a teacher needs both professional mastery and wide general knowledge of subject (professional competence) during the oral and written communication. Modern higher school is aimed more at the formation of creative abilities than just developing mental skills of the future specialist. The ability to use some acquired knowledge in a creative way represents social value since it helps the specialist to perform his social and professional

functions, to adapt quickly to new economic conditions, contributes to a flexible transition from one activity to another. Professional competence is determined by the correct application of professional terms in the professional activity.

Field-based education is particularly critical to the biological sciences, providing fundamental training for key disciplines such as botany, zoology, ecology, physiology, systematics, and conservation science [1, 4, 11]. Field studies underlie the conceptual and technical bases for these disciplines and are required to ensure their healthy growth. Now, as society struggles to respond appropriately to losses of biodiversity, range shifts due to climate change, and the emergence of new human pathogens, the decline in opportunities for field study means that subsequent generations of biologists will be increasingly divorced from the primary setting, the natural environment, in which the phenomena that they study occur. As the capacity to modify biological systems expands from genomes to ecosystems to global cycles, it is imperative that scientists and the broader public are able to critically evaluate the outcomes of these changes in the context of complex natural settings. Within academia, this need also applies to the educators charged with training future generations of problem-solvers [7]. In summary, field studies are an essential component of every scientist's training [4].

Fieldwork tasks should be as productive as possible and recognize ways in which the learning experience could be further enhanced [2]. Enhancements range from a staged sequence of enquiry-based exercises [5] through use of mobile devices to utilise travel time effectively [1, 3]

The field practice is a very important practice link in pharmacy undergraduate education, and it is an important teaching link of botany theory [12].

The field-based training is a type of practical and research activity that is important during the professional training of students for their future professional activity, including environmental education of schoolchildren. The program in biology for a secondary school involves teaching the elements of research work with plants and educational excursions. Thus a biology teacher must have necessary skills of arrangement and conducting excursions in nature, research and practical work, i.e. he/she must be professionally competent.

In this paper we propose to analyse the conditions and methods of formation of terminological competence of biology students during the field-based training in botany, the section «Anatomy and morphology of plants». Its goal is to form the skills to distinguish plants

in nature and describe them as organisms; to master a field method of research and a laboratory one for studying streptophyta; to study species composition of plants in Dnipropetrovsk region; to reveal anatomical and morphological peculiarities of plants conditioned by the mutual influence of organisms (symbiotic, competitive, parasitic, allelopathic) and their interaction with non-living components of environment (morphological peculiarities of plants being a part of different ecological groups); promotion of activities aimed at the environmental protection.

The main tasks of the practice are consolidation and broadening of knowledge about the anatomical and morphological peculiarities of plants of different localities; mastering the techniques of collecting plant specimens and making herbaria, compiling systematic and biological collections; forming the skills to carry out excursions in different biotopes (steppe areas, forest plantations, meadows, agrophytocenoses, coastal and anthropogenically transformed areas, etc.); formation of a caring attitude to the environment, studying rare and endangered species of local flora [8].

During the field-based training students study species composition of flora, zonal and anthropogenically changed vegetation, carry out phenological observations, reveal biological and ecological peculiarities and distribution of different plant species, work out the methods of morphological analysis and identification of plants as well as the methods of collecting, fixation and laboratory treatment of field data.

The summer field-based training in anatomy and morphology of plants aims to systematize and consolidate students' knowledge in botany (including understanding and proper use of botanic terminology); to acquire the methods of collecting of algal and mycological material in nature, making herbaria of vascular plants; to teach students to make morphological and biological descriptions of woody and herbaceous plants of local flora, to determine their systematic position according to the identification guide; to apply the skills of carrying out geobotanical descriptions of a plot (formation of skills to carry out a research in nature).

The field-based training ensures actualization, systematization and consolidation of the ecological and botanical term system concerning the anatomical (tissue level of organization) and morphological (organ level of organization) plant structure, the specificity of anatomical and morphological structure of plants being a part of different ecological groups depending on the humidity level (hygromorphic plants), soil condition (trophomorph species), soil texture,



temperature (thermomorphs, climamorphs), correlation with a certain type of phytocenosis (cenomorphs) etc.

It should be noted that knowledge and skills acquired and consolidated during the summer field-based training represent the basis for the further learning of academic subjects of fundamental (natural science) and scientific training.

***I. Early spring excursions*** are held in April or May and they are timed to the study of ephemerals and ephemeroïds, phenological observations in nature at the beginning of the plants vegetation. They are usually carried out in park areas or a botanical garden after classes. During this type of excursions students work out ecological and botanical term system related to prevernal vegetation, life cycle and life forms of plants: ephemerals, ephemeroïds, underground modifications of shoots (tubers, bulbs, rhizomes, corms), rosette shoots, vegetation, juvenile, verginile, generative and senile stages of plants development, budding and flowering, an inflorescence, a habitus, a herbaceous plant, a shrub, a subshrub, a dwarf shrub, a dwarf subshrub, a tree, vegetative and generative buds, catkins, pollinosis etc.

The summer field-based training in botany includes some excursions in nature (in June) to different biotopes: steppe areas, meadows, coastal areas, man-made forest plantings (forest belts and park areas), anthropogenically transformed areas, agrophytocenoses and conservation areas. During these excursions students have an opportunity to study the species diversity of vegetation communities in the biotopes mentioned above and peculiarities of the anatomical and morphological plant structure that ensure plant adaptations to different growth conditions.

***II. The study of steppe vegetation.*** The zonal type of vegetation in the Dnipropetrovsk region is the steppe, but it has been preserved in its original form only in locations inaccessible to farming or on the conservation areas. As a result students can learn the main representatives of steppe flora during the excursion to Kryvyi Rih Botanical Garden of the National Academy of Sciences of Ukraine (exposition of steppe vegetation) and the excursion to the nature monument «Rocks of MODR». During these excursions the students work out some notions referring to ecological and biological system, for example: zonal vegetation, climax communities, steppe plants, sclerophytes, succulent plants, heliophytes, psammophytes, petrophytes, halophytes, arid climate etc.

***III. The study of meadow vegetation.*** The students can learn about meadow and coastal vegetation during the excursions to the lake Solone, the ponds on «Terminal» and the

Karachunovsky reservoir. This kind of excursions is related to mastering such terms of ecological and biological system as meadows, meadow vegetation, coastal vegetation, paludant, eumesophyte, mesophyte, xeromesophyte and mesoxerophyte, hygrophyte, heliophyte, sciophyte.

**IV. The study of agrophytocenoses.** Excursions to agrophytocenoses are necessary for revealing the functional peculiarities and supporting the monocultural growth of plants; functioning of climax multi-species zonal communities. There the students practise using such terms of ecological and biological system as phytocenosis, plant community, biocoenosis, biogeocenosis, monoculture, cultivated plant, weed, ruderal and segetal vegetation, expansion, vital force, competitors, stress tolerators and ruderals etc.

**V. The study of anthropogenically transformed areas.** The aim of excursions carried out in such kind of biotopes is to reveal the specific features of anthropogenic changes of natural zonal vegetation. So far as Kryvyi Rih is a city with developed mining and metallurgical industry, its basis is represented exactly by ecotopes of anthropogenic type. There are some restrictions for carrying out training excursions on industrial territories, but we have access to adjacent areas that also have a high anthropogenic load. It is possible to study the vegetation in sanitary-hygienic zone (forest plantings) of ore-dressing enterprises. The main goal of these field studies is application and consolidation of terms concerning anthropogenic flora, e.g.: melioration plant, sanitation, ruderals, plants of residential area, anthropogenic transformation, anthropogenic load, vegetational fluctuation and its types, etc.

It is obvious that during the excursions the students constantly revise and use their knowledge of anatomy and morphology of vegetative and generative parts of plants, adaptive peculiarities in the morphology of these parts, vital forms, ecological groups of plants, types of reproduction and habitat of plants paying attention to the following aspects:

1. *Non-vascular plants* (also known as thallophytes or ‘lower plants’) and fungi: ecological groups of non-vascular plants, their value in biocenosis; morphological features of the sporocarp or fruiting body structure of different fungi classes and genera, a type of their nutrition;

2. *Vascular plants* (also known as streptophyta or ‘higher plants’): plant propagation and plant life-forms; differences in the structure of sporous and seed plants of different systematic groups (alternation of sporophyte and gametophyte generations); structure of seeds and

seedlings (comparative analysis of monocotyledonous (monocots) and dicotyledonous (dicots) plants); morphology of vegetative organs of plants such as a root, a shoot, modified stems; structure of plan generative organs (morphology of the gynoecium, the androecium, the perianth, racemose (monopodial) and cymose (sympodial) inflorescences); structure of fruits (dry and fleshy, simple, aggregate and multiple or collective fruits).

### **Conclusions and prospects for further research**

All things considered we can come to the conclusion that the formation of students' terminological and professional competence is realized when they learn professional academic disciplines. The formation and improvement of the professional and terminological competence of future biology teachers in their professional field is achieved by forming the motivation to independent work aiming the improvement of professional communication and implementation of specially developed methodology.

The experience of educational and practical activity of biology students has shown that much attention is paid to the revealing of plants adaptation to growth conditions, to issues of protection and reproduction of flora, to actualisation and consolidation of theoretical knowledge acquired during the study of the discipline «Botany with the basics of geobotany», to mastering practical skills of plants study in nature. The future teacher will be able to realize these practical skills of field research when he works with students at school during excursions in nature, optional classes, extracurricular and scientific work (managing students' scientific research). So it is obvious that the field-based learning in botany contributes to the consolidation of theoretical knowledge and enables the formation of practical skills in various field conditions, provides the ecological approach to learning, and it is an important stage of training highly qualified specialists in the system of modern pedagogical education.

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### *Анотація*

У роботі проаналізовано проблеми термінологічної роботи під час навчально-польової практики з ботаніки та розглянуто засоби та послідовність формування професійно-термінологічної компетентності майбутніх учителів біології. Доведено, що підвищення рівня професійно-термінологічної компетентності студентів створює передумови зростання наукової обізнаності студентів та покращення якості навчальної діяльності під час фахової практики.

Біологія базується на результатах польових досліджень та лабораторних відкриттів. Тому навчання у польових умовах надає суттєві практичні знання, що сприяють розвитку творчості вчителів, підвищують екологічну грамотність та екологічну відповідальність. Важливою складовою навчання є змістова грамотність. Для підвищення рівня грамотності, передусім необхідним є формування активного фахового словника.

**Ключові слова:** термінологія, професійно-термінологічна компетентність, навчально-польова практика з ботаніки, майбутній вчитель біології.

### *Аннотация*

В работе представлена проблема терминологической работы во время ботанической учебно-полевой практики, рассмотрены средства и последовательность формирования профессионально-терминологической компетентности будущих учителей биологии. Доказано, что повышение уровня профессионально-терминологической компетентности студентов создает предпосылки роста научной осведомленности студентов и улучшения качества учебной деятельности во время профессиональной практики.

Биологические знания базируются на результатах полевых исследований и лабораторных открытий. Поэтому обучение в полевых условиях дает существенные практические знания, которые способствуют развитию творчества учителей, повышают экологическую грамотность и экологическую ответственность. Важной составляющей обучения является содержательная грамотность. Для повышения уровня грамотности определяющим условием является формирования активного профессионального словаря.

**Ключвые слова:** терминология, профессионально-терминологическая компетентность, учебно-полевая практика с ботаники, будущий учитель биологии.

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