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The role of pharmaceutical terminology, botanical and chemical nomenclature in the formation of professional terminological competence of future pharmacists

Introduction. Current changes in the healthcare systems set high demands on the quality of how health professionals are educated and trained, what material they learn and how the process of learning is conducted. According to WHO, all health professionals must be appropriately and adequately prepared to support a global policy framework for health. Exploring the topic of Preparing the Future Pharmacist: Curricula Development by the World Health Organization, action-oriented consultation of experts in pharmaceutical education and pharmacy practice agreed on the working objectives, one of which is to promote interdisciplinary education. Designing interdisciplinary learning involves careful planning and providing a guideline for the realization of the integration of two or more disciplines in an educational context.

The highly qualified and educated future pharmacist must have a perfect competence in mother tongue and in a foreign language, which

will define a good command of professional terminological competence. Future pharmacist, using professional language, is to form and present information correctly in oral and in written form while interacting with colleges that lead to mutual understanding and adequate treatment. Moreover, the terminological competence helps to improve the ability to perceive profoundly the special literature published in foreign languages and to develop professional omnifarious erudition.

The research of professional training of future specialists in the context of formation of terminological competence has been conducted by the following scientists: O. Kiselova, I. Pertsev, I. Vorona, L. Viktorova, N. Golub, M. Guts, Ya. Yanush and others.

Competencies are often described as significant job-related knowledge, skills, abilities, attitudes and judgments required for competent performance by members of a profession. Researchers have found the concept of competence attractive for describing essential human knowledge, attitudes, and skills at work, because of the concept's focus on the relation between person and work. Competencies are assumed to be recognizable, assessable, and relevant for practice. Moreover, competencies can be developed, learned, and described at different levels, and are supposed to have a strong relationship with organizational effectiveness.

Pharmacists communicate with and provide education to groups and individuals to promote and support optimal patient care and wellbeing. The issue of the formation of professional terminological competence of future pharmacists is closely connected with teaching Latin in medical universities. The system of international terminology is mostly based on Latin and Greek linguistic substratum. Profound learning of pharmaceutical terminology requires the deep knowledge of etymology and meanings of Latin and Greek word-building elements which clarify and determine meanings of terms. In general, the scientific terminology system is based on a mixed type that provides the importance of being familiar with the Latin and Greek phonetics, grammar and syntax [2].

Pharmaceutical terminology is regarded not only as the main conceptual and terminological means of communicating the information but also as a legal basis for making decisions and executive actions. Incorrect usage of pharmaceutical terms can have a negative influence on the quality of given pharmaceutical service, that is why every term must briefly and accurately express the definition of specific notion or technological process, or product etc. [5]. Pharmaceutical terminology is not isomorphic

enough, that is connected with the use of other terminologies, which have been composed previously (chemical, botanical, pharmacognosy and technological). Such diversity of terminological systems used within pharmaceutical terminology and the lack of isomorphic structure makes it difficult to teach and learn. Moreover, that is caused by the practice of composing terms (names) of medicines randomly and their broad assortment in the pharmaceutical market [13]. The great importance of a good command of pharmaceutical terminology in future pharmacists determine the strong need for the more careful planning of educational process regarding this issue.

The basics of pharmaceutical terminology are learned simultaneously by future pharmacists while learning different disciplines which are connected with a pharmacy (from Greek *pharmakeia* – drug creation). Modern pharmacy is based on the complex of scientific disciplines, such as pharmacognosy, pharmaceutical chemistry, pharmaceutical technology, biotechnology and pharmacology. The terminology of those disciplines interpenetrates, forms interdisciplinary bounds and makes a terminology complex which is called pharmaceutical terminology. For this reason, a scientific meaning of the pharmaceutical terminology is dependent on a specialist. In the terminological system there are terms, which denote the names of basic notions, for example the names of medicines, medical form and active pharmaceutical ingredient (API), and nomenclature names, which demonstrate features of any subjects, which occur regularly, for example the assortment of products which is produced by the pharmaceutical company. A set of nomenclature names within one classification (botanical or chemical) compose a nomenclature. Unambiguous names are essential for effective scientific communication; names can only be unambiguous if there are internationally accepted rules governing their formation and use. **The International Code of Botanical Nomenclature (ICBN)** is the set of rules and recommendations dealing with the formal botanical names that are given to plants.

The names of herbs used in Pharmacopoeia, pharmacology and prescribing differ from the names of herbs used in the botanical nomenclature. In the botanic nomenclature, according to K.Linney, every herb possesses two names which are generic and specific. In the pharmaceutical terminology, herbs possess either a generic or a specific name. While writing and reading prescriptions future pharmacist faces the problem of correct using of botanical herb name and pharmaceutical herb name. Today there are at least 120 distinct chemical substances

derived from plants that are considered as important drugs currently in use. These chemical substances, which are derived from plants, are shown in the table below.

Table 1. List of a drug derived from plants showing the difference between Botanical herb name and Pharmaceutical herb name

Botanical herb name	Pharmaceutical herb name	English translation	Drug	Action
Adonis vernalis	Adonis(idis) vernalis,m	pheasant's eye	Adoniside	Cardiotonic
Berberis vulgaris	Berberis, idis f	common barberry	Berberine	Treatment for bacillary dysentery
Cinnamomum camphora	Camphora, ae f	camphor tree	Camphor	Rubefacient
Papaver somniferum	Papaver,eris n	poppy	Codeine	Analgesic, antitussive
Convallaria majalis	Convallaria,ae f	lily-of-the-valley	Convallatoxin	Cardiotonic
Curcuma longa	Curcuma (ae) longa, f	turmeric	Curcumin	Choleretic
Digitalis purpurea	Digitalis,is f	purple foxglove	Digitoxin	Cardiotonic
Glycyrrhiza glabra	Glycyrrhiza,ae f	licorice	Glycyrrhizin	Sweetener, treatment for Addison's disease
Gossypium species	Gossypium,i n	cotton	Gossypol	Male contraceptive
Hyoscyamus niger	Hyoscyamus, i m	black henbane	Hyoscyamine	Anticholinergic
Mentha species	Menta (ae) piperita, f	mint	Menthol	Rubefacient
Papaver somniferum	Papaver,eris n	poppy	Morphine	Analgesic
Valeriana officinalis	Valeriana,ae f	valerian	Valapotriates	Sedative

The process of acquiring terminological competence can be complicated with the fact that future students meet lots of peculiarities in the pharmaceutical terminology and botanical nomenclature. The emphasis should be placed on the difference between botanical herb name and pharmaceutical herb name. The pharmaceutical name is usually derived from the Latin botanical name and consists of a term indicating the part of the plant used followed by the genus name. Sometimes the species name is also added in cases where more than one member of a genus is included in the raw plant material. That is essential for interpreting prescription, where the raw plant materials are expressed by the pharmaceutical herb name, rather than the name of herbs used in the botanical nomenclature. The raw plant materials, which are used in prescribing, are demonstrated below.

Table 2. The list of raw plant materials using the pharmaceutical herb name in comparison with botanical nomenclature

Raw plant materials	Translation	Botanical herb name	Pharmaceutical herb name	Translation
foliorum, radicis Belladonnae	leaves, the root of barberry	Berberis vulgaris	Berberis, idis f	common barberry
foliorum Digitalis	leaves of foxglove	Digitalis purpurea	Digitalis, is f	purple foxglove
radicis Glycyrrhizae	the root of licorice	Glycyrrhiza glabra	Glycyrrhiza, ae f	licorice
cortices radicem Gossypii	the bark of roots of cotton	Gossypium species	Gossypium, i n	cotton
foliorum Hyoscyami	leaves of henbane	Hyoscyamus niger	Hyoscyamus, i m	black henbane
capitum Papaveris	poppy head	Papaver somniferum	Papaver, eris n	poppy
rhizomatum cum radicibus Valeriana	rootstock with roots of valerian	Valeriana officinalis	Valeriana, ae f	valerian

The complication of mastering terminological competence can be caused by the diversity in terminology. One pharmaceutical herb name

for raw plant material can be used for several names of herbs used in botanical nomenclature. For example, "radicis Bupleuri" (the root of thorowax) is the name for raw plant material of either *Bupleurum chinense* or *Bupleurum scorzoneraefolium* as both species are interchangeable in their applications. Another example is "radicis Angelicae" (the root of angelica), which can describe the raw plant material of one of three species: *Angelica dahurica*, *Angelica anomala*, and *Angelica taiwaniana*. However, "radicis Angelicae sinensis" (the root of "female ginseng") is the name of the raw plant material of a different herb, with very different properties from "radicis Angelicae", and is distinguished by the explicit inclusion of the species name, *sinensis*, in the pharmaceutical herb name. Moreover, in some cases raw plant material may consist of several species of different herbs which can be found in botanic nomenclature. The example of this is "herbal Jinqiancao" (herb of gold coin grass), which can consist of five species: 1. *Glechoma longituba*; 2. *Desmodium styracifolium*; 3. *Lysimachia christinae*; 4. *Dichondra repens*; and 5. *Hydrocotyle sibthorpiodes*[12].

Being taught the difference between botanical herb name and pharmaceutical herb name during the educational process of acquiring terminological competence, the future pharmacist can be able to demonstrate the high level of professional terminological competence in the working field. Interactive teaching methods are important and must be used during terminological acquisition. They help students to apply language and the process of the formation of terminological competence can be thorough and interesting[10].

Several of the drugs sold today are simple synthetic modifications or copies of the naturally obtained substances [12]. The original plant substance or chemical name is shown in the Table 1. under the "drug" column rather than the finished patented drug name.

Mastering chemical nomenclature is a very important step in the formation of professional terminological competence of future pharmacists. Chemical nomenclature is a set of rules to generate systematic names for chemical compounds. The knowledge of chemical nomenclature is needed to train competent pharmacists for the ever demanding pharmaceutical services.

The future pharmacist is faced with chemical nomenclature while dealing with prescriptions on magistral medicines and official medicines. They are supposed to know the clear difference between those two types of medicines. Magistral medicines are prepared extemporaneously according to a physician's prescription and official medicines denote

a chemical or pharmaceutical preparation kept in stock. The magistral prescriptions always have the names of chemical compounds which are used to achieve the primary therapeutic effect. The names of acids, salts, esters and others, which are written in magistral prescriptions, are mostly used in Genetivus singular case in Latin. Students find it difficult to memorize all rules of prescribing.

We can observe the complexity of the formation of chemical nomenclature is shown in the Table 3.

Having insufficient knowledge of chemical nomenclature can lead to mistakes and errors in prescription, which make prescription invalid. A prescribing fault can arise not only from the choice of the wrong drug, the wrong dose, the wrong route of administration, and the wrong frequency or duration of treatment, but also from inappropriate or erroneous prescribing. Inaccuracy in writing and poor legibility of handwriting, the use of abbreviations or incomplete writing of a prescription can lead to misinterpretation. Prescription errors are typically events that derive from slips, lapses, or mistakes, erroneous prescription due to similarities in drug brand names or pharmaceutical names.

Table 3. The list of raw plant materials using the pharmaceutical herb name in comparison with botanical nomenclature

Alcohol	Acid	Latin suffix	English	E.g.
Gen. sg. – i (2 decl.)	Nom. sg.–as, Gen. sg. – atis. (3 decl.)	-at- (is)	-ate	Amyl nitrate – Nom. sg.– Amylii nitras , Gen. sg. – Amylii nitratis
Gen. sg. – i (2decl.)	Nom. sg.–is, Gen. sg. – itis. (3 decl.)	-it- (is)	-ite	Amyl nitrite – Nom. sg.– Amylii nitris , Gen. sg. – Amylii nitritis

According to students' answers to the questionnaire conducted after learning that material, the significant percentage of students (70%) regards botanical nomenclature and chemical nomenclature the most complicated topics and the substantial percentage of students (60%) emphasizes the strong need in more profound practice in botanical nomenclature and chemical nomenclature.

We are convinced that the competence-based approach at the educational process provides the training of future specialists with the required comprehensive result. The traditional methods of the educational process applied at universities, such as lectures, practical classes, explanations, exercises and others, are important for professional development but their limitations are observed when the competence is being formed.

We believe that modern education should be focused on the student's independent activity, the organization of self-learning environments, experimental and practical training where students have a choice of actions and can use initiative, as well as flexible training programs where students can work in a comfortable rhythm. Interactive methods of teaching encourage interest in the training material; provide high motivation and profound knowledge, which contribute to the complex terminological competence.

Being taught pharmaceutical terminology, botanical and chemical nomenclature using interactive teaching methods at the educational process of acquiring terminological competence, the future pharmacist can be able to demonstrate the high level of professional terminological competence in the working field.

Conclusions and prospects for further scientific research. Thus, the course of Latin is practically oriented and aimed at preparing future pharmacists for the professional terminological competence, the central task of which is mastering the skills of effective professional communication. This topic worth further investigation; the development of the methodology of using interactive technologies in the process of teaching pharmaceutical terminology, botanical and chemical nomenclature is needed.

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Abstracts

BLAHUN SOPHIA. Rola terminologii farmaceutycznej, nomenklatury botanicznej i chemicznej w kształtowaniu fachowej kompetencji terminologicznej przyszłych magistrów farmacji.

W artykule omówiono rolę terminologii farmaceutycznej, nomenklatury botanicznej i chemicznej w kształtowaniu fachowej kompetencji terminologicznej przyszłych farmaceutów. Określono pojęcie «kompetencji terminologicznej przyszłych magistrów farmacji». Scharakteryzowano wykorzystanie technologii interaktywnych w nauczaniu terminologii farmaceutycznej, nomenklatury botanicznej i chemicznej. Przeanalizowano potrzebę sformułowania fachowej kompetencji terminologicznej przyszłych farmaceutów.

Słowa kluczowe: fachowa kompetencja terminologiczna, terminologia farmaceutyczna, nomenklatura botaniczna, nomenklatura chemiczna, przyszły magister farmacji.

БЛАГУН СОФІЯ. Роль фармацевтичної термінології, ботанічної і хімічної номенклатур у формуванні професійної термінологічної компетентності майбутніх магистрів фармації. У статті розглядається роль фармацевтичної термінології, ботанічної та хімічної номенклатур у формуванні професійної термінологічної компетентності майбутніх фармацевтів. Визначено поняття «термінологічна компетентність майбутніх магистрів фармації». Охарактеризовано використання інтерактивних технологій у навчанні фармацевтичної термінології, ботанічної та хімічної номенклатур. Проаналізовано необхідність формування професійної термінологічної компетентності майбутніх фармацевтів.

Ключові слова: професійна термінологічна компетентність, фармацевтична термінологія, ботанічна номенклатура, хімічна номенклатура, майбутній магистр фармації.

БЛАГУН СОФІЯ. Роль фармацевтической терминологии, ботанической и химической номенклатур в формировании профессиональной терминологической компетентности будущих магистров фармации. В статье рассматривается роль фармацевтической терминологии, ботанической и химической номенклатур в формировании профессиональной терминологической компетентности будущих фармацевтов. Определено понятие «терминологическая компетентность будущих магистров фарма-

ции». Охарактеризованы использования интерактивных технологий в обучении фармацевтической терминологии, ботанической и химической номенклатур. Проанализирована необходимость формирования профессиональной терминологической компетентности будущих фармацевтов.

Ключевые слова: профессиональная терминологическая компетентность, фармацевтическая терминология, ботаническая номенклатура, химическая номенклатура, будущий магистр фармации.

SOPHIA BLAHUN. The role of pharmaceutical terminology, botanical and chemical nomenclature in the formation of professional terminological competence of future pharmacists.

The paper distinguishes the role of pharmaceutical terminology, botanical and chemical nomenclature in the formation of professional terminological competence of future pharmacists. The importance of professional terminological competence of future pharmacists has been determined. The research concludes that the role of pharmaceutical terminology, botanical and chemical nomenclature is essential in nurturing future pharmacists for their professional terminological competence. The outcomes of this research will be used as evidence to support the need for learning pharmaceutical terminology, botanical and chemical nomenclature to prepare graduates for their future professional terminological competence.

Keywords: professional terminological competence, pharmaceutical terminology, botanical nomenclature, chemical nomenclature, future pharmacist.