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Analysis of the terms of the school course of biology and formation of the concept of presentation of information for the creation of a trilingual dictionary

The article presents the results of the analysis of the terms of the school course of biology with the formation of a paper and electronic version of the trilingual dictionary. The scope of terms used in the school course of biology taking into account inter-disciplines connections, which amounted to 2,135 units, has been determined. Biological terms made 2106 titles for the Russian version of the dictionary, 2159 for English and 1890 for Kazakh. It is determined that 304 terms relate to botany section; to zoology section are 467 terms; to cytology section — 67 terms; to genetics section — 151 terms; to anatomy and physiology section — 322 terms; to molecular biology section — 93 terms; to biotechnology section — 37 terms, 455 terms do not refer to any particular field of school biology course. Biological terms are ranked by frequency of use, consonance of pronunciation in the state, Russian and English languages, broken down by the main sections including botany, zoology, anatomy, physiology, ecology, genetics, biotechnology, molecular biology and evolutionary teaching. The main micro- and macro-composition components of the dictionary entry and dictionary parameters are defined. A set of tertiary dictionaries on biology and an electronic version have been published.

Keywords: biology, terms, trilingual dictionary, vocabulary selection, systematization, frequency, Russian, Kazakh.

Introduction

A prerequisite for the creation of a project of the trilingual dictionary of biological terms was the transition of general education schools of the Republic of Kazakhstan to trilingualism [1], which led not only to the need for training of personnel able to teach subjects of humanitarian and natural direction in different languages, but also to the need to update teaching methods that correspond to the best world practices. This requires the renewal of the library stock of schools, the creation of new educational and methodological manuals, scientific literature and handbooks that comply with the principles of multilingualism [2]. The library fund of schools was not prepared for new realities [3].

An earlier questionnaire of biology teachers and high school students [4] showed (1) the need for common textbooks on subjects in English and school terminology dictionaries; 2) deficit of Internet sites with working materials on biology; 3) not all teachers of natural science disciplines were able to independently select the necessary theoretical material in biology, chemistry, geography, physics, mathematics.

President of Kazakhstan N.A. Nazarbayev noted the need to provide schools with competent reference, scientific and educational literature, which would allow pupils and teachers to freely switch from the Kazakh language to Russian, then to English [1].

According to K.T. Baynieva and A.J. Umurzakova [2], the achievement of communicative and linguistic competences, according with the State Standard, depends on students mastering the initial dictionary stock of three languages.

Thus, the use of trilingual dictionaries contributes to increasing the level of knowledge of Kazakh, Russian and English languages, both students and teachers. In addition, the Bologna process provides for the creation and use of e-learning tools that would contribute to the formation and development of cultural and professional competences among students [5, 6]. Thus, it is necessary not only to create printed versions of the trilingual dictionary on biology, but also to create an electronic representation, which will find its place in the Kazakh educational system.

Methodology

The subject of the study were biological terms of the school course of discipline, including textbooks on biology of grade 6–11 on the old educational system (publishing houses «Мектеп» and «Атамұра») [7, 8],

class 7–11 on the updated program (publishing house «Atamura») accessible glossaries, handbooks, tutorials, electronic materials [8–10]. The choice of terms was made manually, based on the relation of lexicographic material to the designation of concepts included in the system of nominations in the field of biological knowledge.

Lexical material was selected according to the principle of a system of requirements, including external (assignments — part of speech; the training stages — topics, biology sections, classes, methods of use) and internal (description units, basic properties, volume, dictionary information structure) dictionary parameters.

In statistical analysis of texts, service words — noun names, after — verbs, adjectives, stable expressions having maximum frequency — were put first. At the end, some terms were cited that did not possess high frequency.

The second principle of selection of terms is to take into account the entry of words into the hyper-hyponymic group, i.e. acting as hyponyms to some generic concepts. For example, oak, birch, topole, olha, spruce, pine and others relate to the generic concept of wood; wolf, fox, corsac, jackal — relate to the generic concept of predators.

The basic analysis of terms is carried out on the basis of frequency, i.e. by the number of terms used in textbooks on the school course of biology. The terms were analyzed on the basis of the occurrence of specific terminology on separate sections, as well as on the basis of the same sound in all three languages.

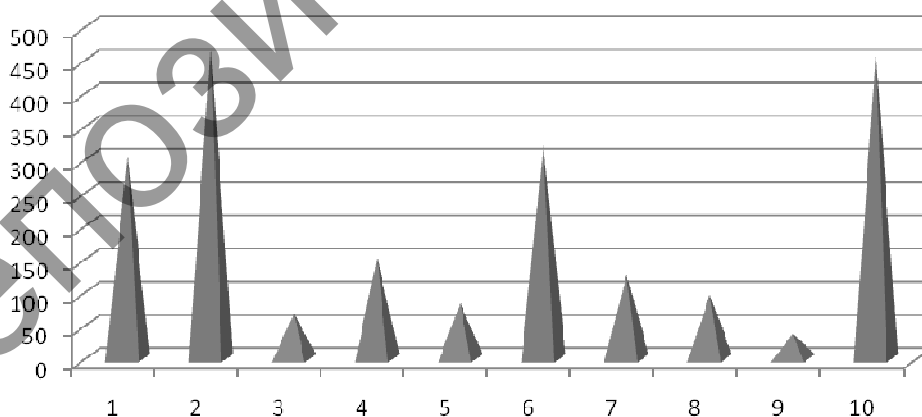
The computer program Adobe Dreamweaver, which is a multi-purpose tool for the development of various electronic textbooks, cognitive programs, websites, etc., was used in the creation of the electronic database of dictionary entries [11].

Results and discussion

The results of the studies showed that the total number of terms used in the school biology course was 2,135, taking into account chemical and physical cross-terms. Only biological terms quantified 2106 titles for the Russian version of the dictionary, 2159 for English and 1890 for Kazakh.

Systematization of terms and concepts is based on basic classical sections of biology, such as botany, zoology, anatomy and morphology, genetics, biotechnology, cytology, molecular biology, ecology and evolutionary teaching.

Analysis of terms of the Russian version of the dictionary showed that 304 terms relate to botany; to zoology — 467 terms; to cytology — 67 terms; to genetics — 151 terms; to anatomy and physiology — 322 terms; to molecular biology — 93 terms; to biotechnology — 37 terms. There are 455 terms highlighted that do not refer to any particular field of school biology course, which we have defined as general biological terms (Fig. 1).



1 — botany; 2 — zoology; 3 — cytology; 4 — genetics; 5 — evolutionary; 6 — human anatomy and physiology; 7 — ecology; 8 — molecular biology; 9 — biotechnology; 10 — general terms

Figure 1. Number of school biology terms per section of discipline

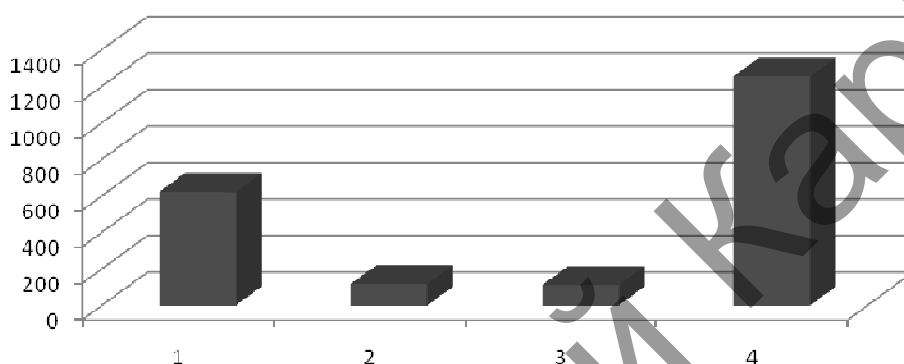
The adopted systematization allows organizing terms according to their appearance in the program of school course of biology, which will contribute to faster search and learning of necessary terms in 3 languages (Kazakh, Russian and English). As a result, a set of 5 separate glossaries has been prepared for printing [12–16], as well as a consolidated dictionary for all sections of school biology [17]. The division of terms

into 5 sets allows the release of compact versions of glossaries that are convenient for students and school teachers to use.

For a number of terms, a hierarchical tree is constructed with branches for each word. When forming a lexical base, the principle of coverage is observed. For example, the phrase «blood vessel» assumes inclusion of the accompanying terms — a vein, an artery, a capillary, blood, blood circulation and others.

Some peculiarities of biological terms appearance in Kazakh textbooks are noted. For example, when analyzing vocabulary by botany (grade 6), it has been found that some terms specified in the interpreted dictionary at the end of the textbook are missing from the main text. Accordingly, the lexical base of the dictionary in Kazakh, Russian and English languages should include all necessary terms on the full course of school biology, as well as names, both having and without equivalents in all three languages.

The list of terms with similar sound is defined, both in English, Kazakh and Russian languages. Thus, out of 2,106 terms 622 have the same sound in Russian, Kazakh and English (Fig. 2, Table 1)



1 — terms that sound the same in 3 languages; 2 — terms that sound the same in Russian and English; 3 — terms that sound the same in Russian and Kazakh; 4 — a term that does not sound the same in 3 languages

Figure 2. Distribution of biological terms by sound similarity

Table 1

Examples of terms, similar in sounding, in 3 languages

English	Russian	Kazakh
Bacillus	Бацилла	Бацилла
Bacteria	Бактерия	Бактерия
Eukaryotes	Эукариоты	Эукариот

118 terms have similar sound in Russian and English, but differ in sound — in Kazakh (Table 2).

Table 2

Examples of terms, similar in sounding, in Russian and English languages

English	Russian	Kazakh
Organ	Орган	Мүше
Rose	Роза	Раушан
Sori	Соры	Шөп-шалам

111 terms sound the same in Russian and Kazakh, but differ in sound from English (Table 3).

Table 3

Examples of terms, similar in sounding, in Russian and Kazakh languages

English	Russian	Kazakh
Enzyme	Фермент	Фермент
Nucleus	Ядро	Ядро
Orange	Апельсин	Апельсин

But a large part of the terms — 1255, do not have the same sound in all three languages (Table 4).

Table 4

Examples of terms that do not have the same sound in all 3 languages

English	Russian	Kazakh
Fruit	Плод	Жеміс
Protein	Белок	Ақуыз
Red currant	Красная смородина	Қызыл қаракат

The degree of occurrence of terms is estimated. The words that are most common and most rare in a school biology course are highlighted. Thus, the most common terms include biology, cell, membrane, anatomy, physiology, plant, animal, organ, organism and others (112 terms in total). Rare terms include the names of animals, plants, certain organs and genetic diseases: fallow deer, elk, jairan, parathymal gland, capillary tangle, myogippus, feijoa, kiwi, spiraea and others (the frequency of their occurrence was from 1 to 5 throughout the course of biology). In order to better remember rare terms, mandatory formation of linguoculturological component and associations is proposed.

Analysis of biological terms and concepts has shown that all selected concepts have a complex multi-level relationship. For example, a chain of concepts is built:

biosphere → population → element of food chain → organism →
→ system of organ → organ → blood vessel → capillary

Based on the results of the preliminary analysis, the organization of the trilingual dictionary was carried out on the principle of the basic generic concept of the term — the section of biology.

A general concept of providing information in a dictionary is formed in the form of a printed glossary based on the distribution of biological terms among classes of learning, where vocabulary is consistently presented in three languages of learning, which will make the glossary universal. Dictionary entries are submitted in three parts: English — Russian — Kazakh, Kazakh — Russian — English and Russian — Kazakh — English.

The general concept of information presentation in the electronic version of the dictionary was formed on the basis of the diagram of connections «mind map» which includes micro- and macro-composition components: audio reproduction of the word; its value (definition); linguoculturological component; a link to an image or video; an indication of part of speech; references to word equivalent in other languages; a ready-made association; antonyms / synonyms, if any, for each particular word; example of uses (Fig. 3).

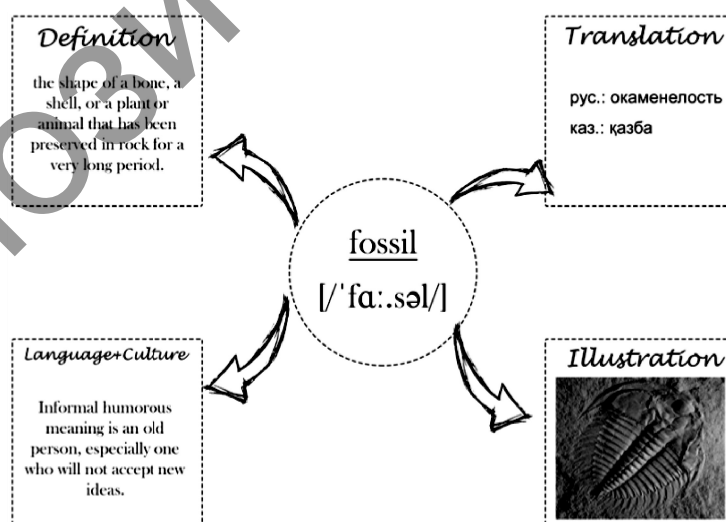


Figure 3. Example of the dictionary entry presentation of the electronic version of the dictionary of biological terms

Sound reproduction provides an opportunity to develop phonetic literacy of users. The meaning of the word in the form of a definition with the provision of an accurate translation makes it possible to familiarize

with the concept in the native language and to use it in other languages with a full understanding of the denotative meaning. Linguoculturological components are placed in a dictionary entry to give specific examples of the use of the term in communications.

Links to a static image or video are provided as an additional source of clarity. Ready-made associations are designed to facilitate the process of learning biological terms. Synonyms and antonyms will link the term to other fields of science and expand the student's outlook.

For a macrostructure of future dictionary the traditional alphabetic principle of arrangement of material is defined, at the same time the arrangement of entrance units is under construction on initial letters (initial-alphabetical arrangement), this order, in turn, is subdivided into arrangement by «letter-for-letter» (letter-by-letter) and much «word-for-word» (word-by-word): from And to I; A to Z.

Conclusion

Thus, during the reporting period, lexical-graphic material was selected at the level of school biology course. The total number of terms used in the school biology course was 2,135, taking into account chemical and physical cross terms. Only biological terms quantified 2106 titles for the Russian version of the dictionary, 2159 for English and 1890 for Kazakh.

Analysis of terms of the Russian version of the dictionary showed that 304 terms relate to botany; to zoology — 467 terms; to cytology — 67 terms; to genetics — 151 terms; to anatomy and physiology — 322 terms; to molecular biology — 93 terms; to biotechnology — 37 terms. 455 terms have been identified that do not apply to any particular area of the school's biology course.

Biological terms are ranked by frequency of use, consonance of pronunciation in the state, Russian and English languages, by main sections including botany, zoology, anatomy, physiology, ecology, genetics, biotechnology, molecular biology and evolutionary teaching. The main micro- and macro-composition components of the dictionary entry and dictionary parameters are defined.

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М.Ю. Ишмуратова, А.Н. Калижанова, Т.В. Марышкина, Г. Дайк, С.У. Тлеукунова

Мектептегі биология курсының терминдерін талдау және үш тілді сөздік жасау үшін ақпарат беру концепциясын қалыптастыру

Мақалада үш тілді сөздіктің қағаз және электрондық нұсқасын қалыптастыра отырып, биологияның мектеп курсының терминдерін талдау қорытындылары берілген. Пәнаралық терминдерді есепке ала отырып, мектепте биология курсына қолданылған терминдер көлемі анықталды, ол 2135 бірлікті құрады. Биологиялық терминдер сөздіктің орыс нұсқасы үшін 2106 атауларды, ағылшын тілі үшін 2159 және қазақ тілі үшін 1890 атауларды құрады. Ботаникаға 304 термин; зоологияға — 467 термин; цитологияға — 67 термин; генетикаға — 151 термин; анатомия мен физиология — 322 термин; молекулалық биологияға — 93 термин; биотехнологияға — 37 термин, 455 термин мектеп биологиясының қандай да бір нақты саласына жатпайды. Биологиялық терминдерді қолдану жиілігі, мемлекеттік, орыс және ағылшын тілдерінде айтылу үндестігі бойынша саралау, ботаника, зоология, анатомия, физиология, экология, генетика, биотехнология, молекулалық биология және эволюциялық ілім кіретін негізгі бөлімдер бойынша бөлу жүзеге асырылды. Сөздік мақала мен сөздіктің параметрлерінің негізгі микро- және макропозициялық компоненттері анықталды. Биология бойынша үш тілді сөздіктер жинағы және электрондық нұсқасы жарияланды.

Кілт сөздер: биология, терминдер, үш тілді сөздік, лексиканы іріктеу, жүйелеу, жиілік, орыс тілі, қазақ тілі.

М.Ю. Ишмуратова, А.Н. Калижанова, Т.В. Марышкина, Г. Дайк, С.У. Тлеукунова

Анализ терминов школьного курса биологии и формирование концепта представления информации для создания трехязычного словаря

В статье приведены итоги анализа терминов школьного курса биологии с формированием бумажной и электронной версий трехязычного словаря. Определен объем терминов, использованных в школьном курсе биологии с учетом межпредметных, который составил 2135 единиц. Биологические термины составили 2106 наименований для русской версии словаря, 2159 — для английской и 1890 — для казахской. Определено, что к ботанике имеют отношение 304 термина; к зоологии — 467; к цитологии — 67; к генетике — 151; к анатомии и физиологии — 322; к молекулярной биологии — 93; к биотехнологии — 37. 455 терминов не относятся к какой-либо конкретной области школьного курса биологии. Осуществлено ранжирование биологических терминов по частотности употребления, созвучности произношения на государственном, русском и английском языках; разбивка по основным разделам, включающим ботанику, зоологию, анатомию, физиологию, экологию, генетику, биотехнологию, молекулярную биологию и эволюционное учение. Определены основные микро- и макрокомпозиционные компоненты словарной статьи и параметров словаря. Опубликован комплект трехязычных словарей по биологии и его электронная версия.

Ключевые слова: биология, термины, трехязычный словарь, отбор лексики, систематизация, частотность, русский язык, казахский язык.

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