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Didactic Features Of a Learner's English-Russian Dictionary of Biology Development.

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ABSTRACT

The article presents the results of the work on the creation of a bilingual (English-Russian) learner's terminological dictionary of biology for Kazakhstan schools with Russian as the language of instruction. The dictionary has been designed on the basis of the previously developed electronic textbook on biology in English for pupils of 7-8 classes of secondary school with Russian language of instruction and forms a unified educational complex. The following principles of the dictionary were selected as the most important methodological and didactic ones: content based integrated learning; appropriateness of the principle of teaching methods; minimization of the linguistic material. The article details the main stages of the work on the dictionary, lexicographical principles of its preparation and introduction of entries of terms, describes some derivation and translation features of the specialized vocabulary of biology, presents some guidelines on the use of vocabulary in the educational process (exemplary tasks for working with biological terms and concepts at different stages of training). This dictionary has some practical value and will be in demand among teachers of biology in those secondary schools of Kazakhstan where polylingual training is implemented.

Keywords: learner's dictionary, lexicography, biology, dictionary entry, terminological vocabulary, the principle of minimizing the language material, appropriateness of the principle of teaching methods, term derivation models, translation methods.

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INTRODUCTION

Since 2007 multilingual education has been actively promoted in the modern Kazakh schools, as it is an implementation of the tasks assigned to the teachers' community by the President of Kazakhstan, N.A. Nazarbayev in his Message (Message of the President, 2007). The Republic has developed a Concept of multilingual education (Zhetpisbayeva, 2009), which proposed three-lingual education in high school (Kazakh, Russian, and English).

On a pilot basis in a number of Kazakhstani schools training in three languages was introduced. Biology as a subject of the natural-mathematical cycle was taught in English. However, Kazakhstan's secondary school system has met a number of difficulties related primarily to the lack of pedagogical staff capable of carrying out the teaching subjects of natural-mathematical cycle in the English language as well as the lack of educational support of teaching of these subjects in English.

For example, an urgent need for teaching biology in the English language in secondary schools is still not provided by an educational complex, meeting the Kazakh state education standards, model programs and, more importantly, Kazakhstan's tradition of teaching the subject in secondary schools (Temirgazina *et al., 2015*). In addition to the basic textbooks, there are no additional training and reference materials on the biology taught in English (for example, learner's bilingual dictionaries in biology). Creation of such specialized dictionaries in a foreign language for a particular stage of education becomes very necessary and urgent.

The planned learner's dictionary is based on the previously developed electronic textbook on biology for pupils of 7-8 classes of secondary school with Russian language of instruction (Temirgazina *et al*, 2015). One of the advantages of this tutorial includes the thematic glossary of key terms and concepts, which is offered to students in each of the 15 modules. This article is the continuation of the idea, in which we summarize the main stages of the learner's dictionary of biology development, suggest possible methodological techniques for working with biological terms in-class, as well as identify some problems of derivation and translation of biological terms.

There are some basic terms of our article. The educational lexicography aims to describe the lexical system of language for training purposes. Its essence as an independent discipline is in conjunction with linguistics and methodology. L.A. Novikov characterizes the educational lexicography as the lexicography of a smaller form and more learning orientation (Novikov, 1969). Broader understanding of the term "educational lexicography" is found at V.V. Morkovkin who defines it as "linguistic and methodological discipline, the content of which is both theoretical and practical aspects of the description of language for teaching purposes" (Morkovkin, 1990).

In parallel with the concept of "educational lexicography", the term "a learner's dictionary", should be clarified. It is now defined as a lexicographical product of any genre and volume, specifically designed to aid in studying the language as a means of transferring people's "informative" states (Morkovkin, 1990). Like any lexicographical work, a learner's dictionary performs certain functions. According to P.N. Denisov, a learner's dictionary is the one in which the minimum lexical system performs four major functions, including training, systematizing, referential, and normative (Denisov, 1993).

Performing all functions of the learner's dictionary is possible only meeting certain requirements to the dictionary. According to A.K. Suleymanova, "A learner's dictionary must meet the following requirements: 1) the uniformity of lexical structure (headwords should only be homogeneous objects); 2) completeness (vocabulary of the dictionary should fully reflect any object class, the vocabulary of any sublanguage, etc., that is to contain the most informative, meaningful vocabulary); 3) the uniformity of the description (lexicographical description of objects must be analyzed with the same degree of detail, uniformly); 4) the legibility of semantic objects; 5) the validity of the information contained in the dictionary; 6) quick and easy ways to find the necessary lexical object and obtain the necessary information " (Suleymanova, 1999).

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METHODOLOGY AND METHODS

In the course of the project we developed the methodological principles of the dictionary of multilingual education. They are the following:

1) mastering the conceptual and terminological apparatus of the subject of biology in English;
2) the principle of appropriateness of teaching methods;
3) minimization the language material.

We present the methodological principles of the dictionary in more details. As it has been already noted, the basis of this dictionary is a previously developed electronic textbook on biology in English for pupils of 7-8 classes of secondary school in Kazakhstan with the Russian language of instruction. It is based on a crucial initial methodological principle - teaching biology in English, rather than learning English through the subject "biology".

In other words, students must fully grasp the knowledge and skills in biology, mastering the biological terminology as well as scientific style in English. This principle allows students to acquire solid knowledge and the necessary competence in the subject "Biology".

Another fundamental approach to creating educational bilingual dictionary of biology is that of educational and methodological feasibility. Being an additional, not major, teaching material, a dictionary increasingly performs the function of reference. It aims to give students explanatory detailed information about various biological concepts and processes that are not adequately represented in the textbook.

The third principle, which supports the creation of the dictionary, is the principle of minimizing the language material. It applies both to the number of entries in the dictionary (about 500 terms in biology), and the depth and breadth of lexicographical interpretation of described units.

The explanations in the learner's dictionary are concise and are given in a very clear form for pupils of 7-8 classes.

The following research methods were selected for a dictionary: a content analysis of basic lexicographical concepts, lexicographical methods and techniques of explanations of terms, and a complex of translation methods and techniques.

The main tasks of the school bilingual dictionary of biology are the following:

- to introduce pupils the interpretation of biological concepts within the school curriculum (grades 7-8);
- to promote mastering of biological concepts included in the curriculum and consolidation of acquired knowledge and skills in the classroom;
- to systematize the specialized biological terminology for training purposes.

RESULTS

The main stages of work on a dictionary

There are some steps on working on the dictionary: the selection of materials, selection of entries and their location, the development of the internal structure of the entry.

In the first stage of lexicographical work it is necessary to determine the scope of vocabulary, that is, a special vocabulary, which will form the basis of a future dictionary. In this connection, the stratification of the vocabulary of the chosen terminology system should be done. During selection of English language material for the bilingual dictionary of biology, we were guided by the criterion of belonging lexical units to the school subject under study. Vocabulary for the dictionary was extracted from authentic texts for high school students by the method of continuous sampling. Having selected the body of terms and concepts, naming and describing certain biological phenomena and processes, the question arose about the selection of entries.

Since the student must master the most important and frequent terms of the selected terminology, this requires more careful selection of terms, rather than their simple inventory. Specificity of a learner dictionary, as it was mentioned above, is its volume. In this case, the volume of the dictionary of biology for secondary schools has made more than 500 units, which is methodologically reasoned.

When developing the bilingual learner's dictionary of biology, we take into account a certain stage of training, the level of knowledge of pupils and their age (in this case, for 7-8 grade students of secondary school). The dominant principle of lexis selection was the principle of the frequency of vocabulary, which largely enabled us to identify the most significant and important concepts of biological terminological system. In other cases, we used the principle of necessity and sufficiency, which allows including in the dictionary less frequent units, but ones carrying a large semantic load. Thus, the dictionary includes terms *intermediate host, pupa, stigma, radula,* and others.

An important issue in the dictionary development is the way to order the material. In our opinion, the commonly used one is an alphabetical order, which sometimes combines the other principles of arrangement. For example, in many cases, a "nest" is used, i.e. combining in one "nest" (within one dictionary entry) words related by a common root, even though it doesn't correspond to the alphabetical sequence. In fact, in these cases there is a deviation from the alphabetical order of words in the direction of alphabetical order of the roots. It is very convenient for some types of dictionaries, for example, word-formation and etymological ones. Consistent implementation of the principle of nesting corresponds to the lexicographical tradition of many languages. In the case of a learner bilingual dictionary, we believe, the alphabetical order of the words is the most appropriate and effective one. A student does not have to think, for example, root words, prefixes and suffixes, which are so diverse in English: *Unconditioned reflexes-innate reflexes: protection, defense, food, migration; inherited.*

The structure of the entry of the learner's dictionary is rather specific. There should be strict unification of methods of delivery of specific linguistic information of the lexemes to help students master their skills of the language usage. The development of the internal structure of the entry as one of the stages of work on the dictionary was as follows. Firstly, a dictionary article includes a headword, which is written in bold and located on the left side. Then a part of speech of a headword is identified (e.g. *n*-noun, *adj*-adjective, *v*-verb, etc.). This information indicates the functioning of a particular lexeme in a speech that helps the student learn how to use language effectively.

Secondly, the idea of phonetic transcription is essential because students who address the dictionary may experience some difficulties in reading and pronouncing biological terms, most of which are borrowed from Latin and Greek. The difficulty lies in the fact that foreign words are often pronounced differently than their written forms. For example:

*Branchiopod*a [ˌbraŋkiə'pəudə]
Chitin ['kaitin]
Crustaceans [krʌs'teiʃ (ə) n].

Thirdly, the interpretation of the headwords should be simple, concise, and accessible. Since the main task of students is to master the foreign terms in biology and their semantic relations, we must pay special attention to the semantic aspect of the description of the term. In the interpretation of the term some reference to other terms and concepts in the dictionary is possible (in this case a reference to the headword also stands out in bold); it promotes rapid inquiry for a student:

Trematodes *are a class of* ***flatworms****, which lead parasitic way of life. They have a body, which is similar to leaf, with two suckers.*
Flatworms*–are bilaterally symmetrical animals. Their flat body is similar to leaf or tape.*
Cyst *– a form of existence of* ***Protozoans.***
Protozoans – *organisms whose body is composed of a single cell with formed* ***nucleus****.*
Nucleus *– a mandatory part of cell at many unicellular and multicellular organisms.*

Fourthly, the presence of the illustrative examples in a dictionary entry greatly facilitates the understanding of the word, reveals its particular use in speech. The inclusion of this element in the internal

structure of the article is justified by the purpose of the dictionary. The use of visibility (illustrations, drawings, diagrams, etc.) would certainly facilitate understanding of biological concepts, but we believe that it is inappropriate for the translation dictionary. Their place is in the monolingual dictionaries, where illustration radically reduces verbal definition.

Finally, there is no doubt about the need to translate the lexical units of the Russian language in the bilingual dictionary. The planned bilingual learner's dictionary helps students to build relationships between the English and Russian equivalents of the respective terms. As noted above, biological terms were borrowed from Latin and Greek. The mainly used method of translation them is transliteration: *inhibitor* (ингибитор), *pharynx* (фаринкс), *tapeworm* (ленточные черви) and others. The sources of the traditional methods of translation are the specialized lexicographical items (The Environment Encyclopedia and Directory, 2005, The New English-Russian Biological Dictionary 2009; Glossary of Biodiversity Terms).

Principles of dictionary compiling

An extremely important thing in the preparation of lexicographical aids is the problem of the vocabulary selection. A clear system of criteria for the selection of vocabulary has been developed in the writings of L. Scherba (1974), I.V. Rakhmanov (1946), P.N. Denisov (1969), V.V. Morkovkin (1977), Y.A. Safyan (1977), T.D. Fomina (1991) and many other researchers. The universally recognized principles of scientific vocabulary selection are linguostatistical approaches to analysis of lexical units of the selected sources, in which the functional analysis of the associated text begins with a list of all lexemes contained in the language of science arranged in descending order of their frequency.

The principle of frequency is evaluated as the most reliable and objective in the works of L. Zasorin (1977), E.A. Shteynfeldt (1963) and other researchers, using this principle in relation to the selection of vocabulary for dictionaries. This principle makes it possible to identify the core of lexical minimum, which brings together the principle of the frequency with the principle of minimizing language for training purposes. Minimization which is the reduction of the vocabulary of the language to a minimum, and compression, i.e. preserving the basic quality-structural and semantic characteristics of the lexical system are the most traditional tasks in the methodology of teaching the Russian language.

Lexical minimum is defined by experts as "the quantitatively greatest combined elements of the language, the properties of these elements and their operating rules, which when combined, form a smaller analog of the language (its model), keeping within the prescribed limits the ability to perform certain functions inherent in language, in whole or some of its variants" (Morkovkin et al., 1985). The lexical minimum offered only those units that are to be learned at a certain stage of learning. According to P.N. Denissov the selected lexical minimum usually contains the most useful vocabulary, grammar and cross-cultural evidence that would allow for the minimum time to provide the students with the most useful knowledge, skills, and abilities (Denissov, 1974).

Minimization of the dictionary material is connected not only with the glossary, but also with the description given in the dictionary entry. The main principle of minimizing the material is the account of the recipient characteristics. A mid-level learner in terms of his/her linguistic competence is very different from the adult speakers as well as from high school students, so as a rule he/she cannot effectively use the dictionary intended for these categories of users: it is difficult to navigate in a dictionary of a large volume; a complex system of symbols and labels makes it difficult to find the necessary information.

When compiling the glossary of a learner dictionary, the principle of necessity and sufficiency plays an important role. This principle may include the units of a low frequency of use, but bare an important semantic load as well as deep information content and are necessary for the comprehension of a functionally related text.

As we are talking about learner's dictionaries, one of the basic principles of vocabulary selection becomes a principle of educational and methodological feasibility. This principle makes it possible to omit some semantically similar linguistic units with a large disparity in their grammatical characteristics and, on the contrary, to justify the inclusion of at least large groups of similar value lexemes and structures with the unity of morphological and syntactic features.

In the development of the dictionary a principle of consistency is also important. Consistency involves the thematic coherence of selected lexical units, presented as hierarchically selected thematic groups, characterized by different types of relationships.

The principle of communicative values is closely connected with the principle of compatibility. It is necessary to select those lexical units, which would be characterized by broad compatibility.

Using all of these principles in the selection of lexical units in the learner's dictionary quite objectively allows determining the volume of the vocabulary and optimizing it. The main requirement to the learner's dictionary is that it should present the most important aspects of lexicology in an accessible form for students. The amount of words in a learner's thematic dictionary (7-10 thousand words) complies with the vocabulary of students and is intended to include only common words.

DISCUSSION

Derivational features of biological terms

The peculiarity of biology, like other sciences, is a terminological richness. The most intensive replenishment of the terminology of the language occurs at the expense of borrowings, affixation and suffixation. As it is known, biology was greatly influenced by Latin and Greek. The dictionary contains the terms borrowings of Latin origin: *flagellum* (жгутик), *nucleus* (ядро клетки), *ciliates* (инфузории), the terms of Greek origin: *cytoplasm* (цитоплазма), *Leishmaniasis* (лейшманиоз), and others.

Affixation is the formation of new single-word terms by adding the Latin and Greek prefixes and suffixes to the root words. Here are some of the terms included in the dictionary: *asexual reproduction* (бесполое размножение), *hermaphrodites* (гермафродиты), *multicellular animals* (многоклеточные животные), *pseudopodia* (ложноножки), *extracellular* (внеклеточный), *dioecious animals* (раздельнополые животные), *homogeneous* (однородный), *hypodermic* (подкожный) and others.

In the English scientific and technical terminology, particularly in the field of biology and zoology, there are a sufficient number of terms consisting of two elements: *Malpighian vessel* (мальпигиев сосуд); *mantlecavity* (мантийная полость). Terms consist of three or more elements, of course, exist, but they haven't been included in the learner's dictionary for obvious reasons.

Special dictionary of basic lexical fund is presented by the terminology that besides the nominative terminology layer (expressed usually by nouns) contains terminated words, expressions and other significant parts of speech (terms - nouns, adjectives) and prepositional-case constructions, functionally performing the same role as the terms.

Terminological patterns are mainly formed according to the following models:

- adjective + noun (*natural selection*);
- (adjective) + noun + preposition of + noun (*salivary glands of amph*ibians);
- noun + noun (*food relationships*).

It is evident that a noun is an integral component of all phrases. Such noun activity indicates its semantic content.

Biology terms translation problems

A well-known Russian expert in the field of translation theory and translation V.N. Komissarov considers that the terms are "the words and phrases denoting specific objects and concepts that experts of a specific area of science or technology operate" (Komissarov, 1990). Their translation causes some difficulties both for novice and experienced translators.

The peculiarities of term translation for the learner bilingual dictionary of biology have been driven by two factors: firstly, the scientific and technical nature of the text and, secondly, by the age and didactic requirements for school textbooks.

When working on the dictionary, we used the following translation techniques:

- Literal translation, a way to translate the lexical units of the original by changing its components, i.e., morphemes or words (in the case of set phrases) to their lexical correspondences in the target language. For example, *flatworm* (плоский червь), *tapeworm* (ленточный червь), *shipworm* (корабельный червь), *oral sucker* (ротовая присоска), *food chain* (пищевая цепь), *artificial selection* (искусственный отбор), *evolutionary theory* (эволюционная теория), *mantlecavity* (мантийная полость), *furfarming* (пушное звероводство) and others.
- Descriptive method, i.e. using expanded explanations of the meaning of the English word: *imago* (половозрелое взрослое насекомое), *externalfertilization* (оплодотворение путем выращивания зародыша в пробирке) and others.
- Transliteration - a way to translate a lexical unit of the original through recreation of its graphical form using the letters of the target language: *Malaria* (малярия), *atoll* (атолл), *inhibitor* (ингибитор), *aorta* (аорта), *reptiles* (рептилии) and others.
- Translation with the change of attribute group order component - *cerebralcortex* (кора головного мозга).

Guidelines on using the learner's dictionary

The specific use of a learner's dictionary in the educational process, we believe, lies in its reference function. A learner's dictionary does not imply a focused and consistent study of materials it contains, similar to the textbooks. Strong absorption of the material can be carried out only when the students timely and systematically master the necessary vocabulary, learn the language of science through studying the technical terms. The exact understanding of the terms allows a deeper insight into a particular area of science, consciously assimilate it.

By working with the terminology in the classroom, the teacher can use the learner dictionary in different ways: to inform (reference) with a new concept, consolidate the knowledge and skills of pupils, checking and monitoring the students' knowledge. Accordingly, the forms and methods of work can be very diverse. Below, we offer some guidelines that are designed to help teachers of biology to conduct dictionary work.

TASKS

For students of grade 7 the tasks connected with research entries explaining certain biological phenomena will be of some interest. For 8th grade students the tasks, based on a comparative analysis of materials of different dictionaries (educational and explanatory, encyclopedic) can be offered. Here are some options for tasks that the teacher can use in different classes:

• In order to familiarize with the new educational material:

- Based on the entry "*tapeworm*" in the dictionary, tell us about the structure of tapeworms. As optional task, draw the appropriate illustration.

- Carefully examine any entries. On the basis of this interpretation, bring your own illustrative example.

- Analyze a specific dictionary entry in a learner's dictionary and other (explanatory, encyclopedic, specialized) types of dictionary. Add the interpretation of the term of the learner's dictionary with two (three) important details.

• In order to consolidate the learning material:

- Analyze the dictionary entries "*flying birds*", "*floating birds*", "*nomadic birds*", "*migratory birds*". Identify the features of each group of birds.

- Examine the entries "*roundworm*" and "*beeftapeworm*". Compare the habitat and the structure of a roundworm and a tapeworm. Find the similarities and differences.

- Fill in the table "The description of the class of bony fish" (see Table 1.).

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Table 1. The description of the class of bony fish

Order	Representative	Lifestyle features	Structure features

This type of a task promotes better memorization as well as develops the ability to analyze and categorize.

• For the purpose of monitoring and evaluation of students' knowledge:
- Guess the word by its definition.

The scientific study of life existent of the past geological periods, including the study of fossils to determine organisms' evolution and interactions with each other and their environments (paleontology).

As a task type, students can be offered to match the names of concepts / terms to suitable definitions (1b, 2a, 3c):

1. *Agrocenosis*
2. *Biocoenosis*
3. *Biogeocoenosis*

A. *The totality of animals, plants, fungi and microorganisms occupying a land or water.*
B. *A community of organisms living in the land of agricultural use occupied by sowing or planting crops.*
C. *Natural communities that have been developed in a particular area, the totality of living organisms and environmental conditions.*

- Are these statements true or false?

1. Comparative Anatomy studies the structure and evolution of organs by comparing different types of living beings. (True)
2. Consuments are destroyers of organic substances (False)
2. Consuments are destroyers of organic substances (not true)

- Write terminology dictation on the topic. The following concepts are suggested: *reacclimatization, theriology, mammals and others.*

The effectiveness of this work is clear: the vocabulary of students is enriched - at the expense of recognition of unknown and semantic clarification of known words - and the grammatical structure of speech - in trying to express their thoughts using the grammatical structures of a certain style of speech. The sense of language as well as the ability to understand the figurative-expressive possibilities of language units are developed and improved. All this, in turn, promotes the development of creative abilities of the students themselves, often causing a desire to create a similar product of its own (puzzles, crosswords).

A convenient and effective way to store and use information for vocabulary assignments is applying cards. They can be used in different grades and in different conditions. Below we offer some cards that can be divided into different groups depending on the purpose of use:
a) can be used only in the classroom (in all classes and in specialized classes, one parallel, in different parallels)
b) can be used only in extracurricular activities (clubs, elective courses)
c) can be used only as homework
d) can be used both in the classroom and as homework.

Depending on the use of cards, they can help to organize the work in the classroom and during extracurricular activities.

Card 1

1. Explain how you understand the word .....
2. Check yourself on the learner dictionary.

3. Does the interpretation of your words differ from the dictionary entry interpretation? What new information about the word (as compared with your interpretation) is there in the dictionary?
4. Make a sentence with the word. Define its role in the sentence.

Card 2
1. Using the learner's dictionary, make a small text (3 -5 sentences) with the words of the thematic group .....

Card 3
1. Analyze the dictionary entry ....in a learner dictionary.
2. Make up a dictionary entry for the word .....

Card 4
1. Analyze the entries for words ....in 2-3 different types of dictionaries.
2. For these dictionaries make entries of the word .... (with one word in different dictionaries).
3. In what thematic group can you put these entries in the dictionary with the ideographic principle of construction?

Certainly the proposed tasks do not show all possible situations of using dictionaries in the classroom. Tasks can be diverse, but they should be reasonably dosed. It is necessary to remember that the ability to use a dictionary correctly is a complex multi-component ability and its formation should be done gradually and consistently.

CONCLUSION

Thus, we have developed a learner's bilingual dictionary of biology as an additional material to the electronic textbook on biology in English for pupils of 7-8 classes with Russian as the language of instruction. Both a learner's dictionary and an electronic textbook on biology constitute a single educational complex in English. In our opinion, it will be in demand in the general and specialized schools of Kazakhstan, introducing the multilingual education in the educational process. In future, we consider it appropriate to develop similar electronic textbooks and dictionaries in biology (botany, anatomy) for the schools with the Kazakh language of instruction.

Principles of creation of the dictionary of the subjects of science and humanities cycles in English reflect the requirements of the state standard of secondary education of the Republic of Kazakhstan, the specifics of teaching in Kazakh schools. And, accordingly, they can be used to create the learner's dictionaries in English on physics, chemistry, etc. for schools with the Kazakh language of instruction. The proposed principles for the development of learner's terminology dictionaries can be extended and popularized in a scientific and methodical community in Kazakhstan, the CIS countries, and the world scientific community.

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