STRUCTURAL AND SEMANTIC ANALYSIS OF SOME PHYSICS EPONYM TERMS FOR CONTRIBUTION TO TEACHING AND COMMUNICATION

ANÁLISE ESTRUTURAL E SEMÂNTICA DE ALGUNS TERMOS EPÔNIMOS DE FÍSICA PARA CONTRIBUIR COM O ENSINO E COMUNICAÇÃO

ANÁLISIS ESTRUCTURAL Y SEMÁNTICO DE ALGUNOS TÉRMINOS DE EPÓNIMOS DE FÍSICA PARA LA CONTRIBUCIÓN A LA ENSEÑANZA Y LA COMUNICACIÓN

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ABSTRACT: Rapid development of new technologies and products due to discoveries in all fields of sciences, in the Physics field as well, leads to emergence of eponym terms. This phenomenon requires studying and analyzing these lexical units as they often may cause confusion for students as well as for science people in interpreting them in an appropriate way during the learning and communication processes. The relevance of the topic is in considering some linguistic peculiarities of eponyms and eponym term combinations to try to combine education issues and the results of the topic under discussion. Some structural and semantic differences of the same eponym terms in both languages may cause difficulties in their perception and intertransition. The paper provides a comparative analysis, processing, generalization and systematization of some structural and semantic peculiarities of Physics eponym terms in the English and Russian languages. On the base of the analysis of the differences of the lexical units given are the results on some linguistic peculiarities of eponyms in Physics field. The main result of the research is in revealing considerable discrepancies in the structure, meanings and ways of reflection of eponym lexical units in the analyzed languages and in the necessity of their consideration for making some possible contribution to education issues and science terminology. The practical significance of the paper is in combining linguistic analysis and language teaching technology.

KEYWORDS: Linguistics. Language. Structural and semantic peculiarities. Eponym term.

***RESUMO**: O rápido desenvolvimento de novas tecnologias e produtos devido a descobertas em todos os campos das ciências, também no campo da Física, leva ao surgimento de termos epônimos. Esse fenômeno requer o estudo e a análise dessas unidades lexicais, pois muitas*

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vezes podem confundir os alunos e também os cientistas ao interpretá-las de forma adequada durante os processos de aprendizagem e comunicação. A relevância do tópico está em considerar algumas peculiaridades linguísticas de epônimos e combinações de termos de epônimos para tentar combinar questões de educação e os resultados do tópico em discussão. Algumas diferenças estruturais e semânticas dos mesmos termos epônimos em ambas as línguas podem causar dificuldades em sua percepção e intertransição. O artigo fornece uma análise comparativa, processamento, generalização e sistematização de algumas peculiaridades estruturais e semânticas dos termos epônimos da Física nas línguas inglesa e russa. Na base da análise das diferenças das unidades lexicais apresentadas estão os resultados sobre algumas peculiaridades linguísticas dos epônimos na área de Física. O principal resultado da pesquisa está em revelar discrepâncias consideráveis na estrutura, significados e formas de reflexão das unidades lexicais epônimas nas línguas analisadas e na necessidade de sua consideração para fazer alguma possível contribuição para as questões da educação e terminologia científica. O significado prático do artigo está na combinação de análise linguística e tecnologia de ensino de línguas.

***PALAVRAS-CHAVE**: Linguística. Linguagem. Peculiaridades estruturais e semânticas. Termo epônimo.*

***RESUMEN**: El rápido desarrollo de nuevas tecnologías y productos debido a los descubrimientos en todos los campos de las ciencias, también en el campo de la física, conduce a la aparición de términos epónimos. Este fenómeno requiere el estudio y análisis de estas unidades léxicas ya que muchas veces pueden causar confusión tanto a los estudiantes como a los científicos al interpretarlas de manera adecuada durante los procesos de aprendizaje y comunicación. La relevancia del tema radica en considerar algunas peculiaridades lingüísticas de los epónimos y combinaciones de términos de epónimos para tratar de combinar las cuestiones educativas y los resultados del tema en discusión. Algunas diferencias estructurales y semánticas de los mismos términos epónimos en ambos idiomas pueden causar dificultades en su percepción e intertransición. El artículo proporciona un análisis comparativo, procesamiento, generalización y sistematización de algunas peculiaridades estructurales y semánticas de los términos epónimos de Física en los idiomas inglés y ruso. Sobre la base del análisis de las diferencias de las unidades léxicas dadas se encuentran los resultados sobre algunas peculiaridades lingüísticas de los epónimos en el campo de la Física. El principal resultado de la investigación es revelar discrepancias considerables en la estructura, significados y formas de reflexión de las unidades léxicas del epónimo en las lenguas analizadas y en la necesidad de su consideración para hacer alguna posible contribución a las cuestiones de educación y ciencia terminológica. La importancia práctica del artículo radica en la combinación de análisis lingüístico y tecnología de enseñanza de idiomas.*

***PALABRAS CLAVE**: Lingüística. Lenguaje. Peculiaridades estructurales y semánticas. Término epónimo.*

Introduction

Eponym terms usually create some difficulties in comprehending the teaching material offered to the subject learners. While reading the teaching material students should understand

what this or that eponym term means for linking their idea to the whole essence of what is being read. On the other hand, rapid emergence of the lexical units under consideration can make it difficult for science people to be in touch with discoveries being made in the science fields. The paper considers some structural and semantic peculiarities as linguistic ones of English and Russian eponym terms in the Physics field. The results of the research were supposed to enable language learners as well as those interested in the topic under discussion to cope with the lexical units being analyzed more easily for the purpose of making the process of study and communication more effective. The previous studies of eponym terms are mainly devoted to considering them only from the linguistic point of view. Terminological units have been causing an ambiguous attitude of linguists since the remotest times. The delimitation of eponym phenomena was analyzed in the works of Russian linguists Vinokur (1994), Reformatsky (1994). Grinev-Grinevich (2008), Kakzanova (2010), Shelov (2007). Many discussions were devoted to the issues of terms' belonging to the terminological system, their denotation conceptions or their serving just for labeling actual objects or expressing proper names (REFORMATSKY, 1994; GRINEV-GRINEVICH, 2008). Superanskaya (1995), Vakhrameeva (2003, p. 28) pointed out the value of eponym terms from the point of view of culture. The works of Vakhrameeva (2003), Kerber (2013), Kloster (2014), Sharapova (2013), Kosterina (2014) analyzed the origin of the lexical units in various terminologies. In the scientific literature there is little information on considering eponym terminological units in close connection of linguistic research and teaching technologies. Some issues concerning the simultaneous consideration of linguistic analysis of terms and teaching technologies were done in the works of Russian linguists Makayev *et al*. (2018), Sakaeva, Sigacheva and Baranova (2017), Abrosimova *et al*. (2019), Sabirova and Khanipova (2019). The results of the research are aimed at informing the Physics fields' specialists about the inventions and discoveries made by scientists. The research's results could contribute to the terminology science by the investigation of some structural and semantic peculiarities of eponym terms of Physics fields in the English and Russian languages. The material analyzed during the research showed that there are some differences in the structure, meanings and ways of reflection of eponyms and eponym term combinations in the English and Russian languages. Showing these differences made it possible for students to comprehend the information contained in the eponym terms in a proper way. The results of the research were supposed to make some contribution to the development of the terminological science.

Materials and methods

The scientific work conducted was based on the research of eponymous nominations of such scientists as Kazarina (1998), Leichik (1994), Novinskaya (1989), Superanskaya and Vasiliev (2019) and others. The linguists Kerber (2013), Kloster (2014), Sharapova (2013), Kosterina (2014) and others considered epimonization as a derivational method of nomination in various terminologies. The importance of being aware of eponym terminological lexical units, their influence on the increase of terms' number were considered in the works of Russian linguists Makayev *et al*. (2018), Sakaeva, Sigacheva and Baranova (2017) and others. The methodology of the research was presented by the comparison method, the method of processing, generalization and systematization. On the base of the analysis of the differences of the lexical units given were the results on some linguistic peculiarities of eponyms in Physics fields that might contribute to the development of terminology science as well as to making learning process easier. The English-Russian physical dictionary containing about 60,000 lexical units in total including 1,200 eponym terms and eponymous terminological combinations served as a material for conducting the research (TOLSTOY, 1972).

Theory

The scientific literature studied for conducting the research showed that nomination of new discoveries and inventions in all fields of knowledge, including Physics one, enriches the vocabulary of languages thanks to eponyms. There exist too many definitions of the term "eponym". According to the definition of Vakhrameeva (2003, p. 13), an eponym is a term formed on behalf of a scientist who has contributed to the development of a particular field of science and technology. Therefore, eponyms are usually called emerging new lexical units based on proper names, which over time become common nouns in the branch of knowledge in which they appeared. Over time, performing a certain function for naming objects, processes, phenomena, etc., eponyms fall into the category of terms of the corresponding sphere. Examples of eponymous terms expressing the names of inventions, units of measurement, processes, etc. in the field of Physics can be becquerel - a unit of measurement of the activity of a radioactive source, named after Antoine Becquerel; Volt - a unit of measurement of electrical voltage, called after the name Alessandro Volta. Another example is the Curie eponym, which refers to an off-system unit for measuring the activity of a radioactive source. The Russian name of this eponym is denoted by the symbol "Ki", and the international name - by the symbol "Ci". This

eponym is used in nuclear physics and medicine. The anthroponom was named in honor of Pierre Curie and Maria Sklodowska Curie (VINOKUR, 1994, p. 537).

An anthroponom is a proper name that has a double meaning and denotes both the name of a particular person and the name or unit of measure, or process, or an object invented by that person, etc. In this research we considered eponymous terminological combinations in which the eponymous component had already acquired the function of expressing a concept, that is, it began to express a differentiating feature that distinguishes this concept among others. In other words, it has become a term. In these terms, the capital letter had already been replaced by a lowercase letter and the connection with the original denotation had already been completely broken.

The need to study terms, in particular, proper names as terms and components of terms, contributed to the emergence of such a scientific discipline as terminological onomastics, which arose in the late 80s of the XX century (VINOKUR, 1994, p. 185). It explores the origin, structure, and function of proper names used in professional communication.

The range of questions that terminological onomastics explores is wide and includes the study of the linguistic nature of eponymous terms, their structural and semantic features, the origin of a specific term, the study of their composition and functions, their general and specific features, the identification and description of their main models, according to which they are formed, the main trends in their formation and much more (REFORMATSKY, 1994, p. 13).

The emergence of eponyms is an ongoing process due to the contribution of the great personalities of the Anglo-American world, who may be little known to specialists in the target language. Accordingly, Russian inventors may also be unknown to English researchers. New eponyms do not have time to get into modern general and encyclopedic dictionaries, which complicates the interpretation of foreign eponyms. As a result, specialists have to rely on monolinguistic special dictionaries or spend a lot of time on solving problems caused by proper names as determinants of laws, formulas, processes, etc. in various sciences, in the field of Physics, including.

Results

The analysis of examples showed that they are divided into:

- one-component (volt - вольт, ampere - ампер), consisting only of an eponymous component;

- two-component (Kerr cell – ячейка [конденсатор] Керра, оптический затвор, Aurton's ammeter – электромагнитный амперметр);

- three-component (standart Daniel cell – нормальный элемент Даниеля, Lande splitting factor – фактор магнитного расщепления, множитель Ланде, g-фактор);

- more than three-component eponymous terms (Gaede kinetic heat effect – кинетический тепловой эффект (Гедэ), earlier Bohr – Sommerfield formulation of quantum theory – раннее изложение квантовой теории Бора-Зоммерфельда).

Two-, three-component and more than three-component eponymous terms consist of an eponym and common nouns (Kohlrausch bridge – мост Кольрауша; Atwood's machine – машина Атвуда), which can be further divided into technical (Nernst glower – штифт Нернста; Lande splitting – множитель Ланде) and high-tech terms (Pauli spin matrix – спиновая матрица Паули; Yukawa kernel – ядро Юкавы, диффузинное ядро; Fabry – Perot interferometer – интерферометр Фабри-Перо). Technical eponymous terms include the words of a specific subject specialization, while high-tech eponymous terms refer to an integral part of the study of the discipline itself (LEICHIK, 1994).

One-component eponym terms

The analysis of one-component eponymous terms showed that the term of the original (English) language (newton; Mach; maxwell) has an equivalent version in the target (Russian) language (ньютон; мах, число Маха; максвел). Some one-component non-comprehensible English terms expressed by common nouns in the Russian version acquire an eponymous component (etalon - интерферометр Фабри – Перо; fence – 1. направляющая планка 2. радиолокатор, использующий эффект Доплера). There are also examples of eponymous terms, in the English version of which there is an eponymous component, but in a similar Russian version it is absent. Also in the Russian version, another eponym can be used, expressing the author who applied this invention to improve his other subject under study (a. Christie bridge – мост с непосредственным отсчетом; b. Carey-Foster bridge – разновидность моста Уитстона для сравнения близких сопротивлений). In example b, the Russian version contains an eponymous component that forwards Charles Wheatstone to the present inventor. There are also one-component eponymous terms with several interpretations in the translating language (fermion - фермион, частица Ферми, ферми-частица; Kelvin – 1.

по шкале Кельвина, по абсолютной (температурной) шкале 2. киловатт – час; Laplacian – лаплашан, оператор Лапласа, дельта - оператор).

Thus, one-component eponymous terms in English have their equivalent translation options in Russian. There are examples in which, in one language under consideration, there are eponyms, and in another one, they are absent. In some eponymous terms, the meaning of the eponym in one language is conveyed by one option, in another - by a completely different one, i.e., the name of the discoverer of one phenomenon is replaced by the name of another, referring to the discoverer in his invention.

Two- and three-component eponym terms

The equivalence (NOVINSKAYA, 1989) of eponymous terms in English and Russian is also manifested in two or more than two-component lexical units (Cassinian oval – кассиниев овал; Pauli paramagnet – парамагнетизм Паули). In these examples, grammatical and semantic equivalence is traced. In both languages, eponyms perform the function of definition, although they occupy both the prepositional and postpositional positions with respect to the nuclear components in the target language (кассиниев овал; парамагнетизм Паули).

Some two- and three-component eponymous English terms do not have eponyms in the Russian version (Napirian base – основание натуральных лагорифмов; Van Allen belts – радиационные пояса (Земли)). An analysis of the material showed that the absence of the eponym itself can also occur in English terms - common nouns, and in the corresponding Russian variants they consist of both combinations without eponyms and an eponym with common noun (1. cloud chamber/fog chamber – камера Вильсона; 2. rotating-disk vacuum gauge – вязкостный манометр с вращающимся диском, манометр Ленгмюра; 3. slip gauge – плоскопараллельная концевая мера длины, плитка Иогансона).

Multi-component eponym terms

The phenomenon of absence of an eponym component in one language and the presence of the same eponym component in its translation in another language occurs with multi-component terms as well. In the first Russian version of the multi-component term “electric hyperfine-structure alignment”, the eponym itself is absent (1. радиоспектропический метод измерения сверхтонкой структуры спектра), and in the second version the eponym is used

(2. метод Паунды). From this, it follows that the choice of the desired variant of the eponymous term under consideration requires knowledge of the context of the text in question to use either only the general name of the method or its detailed definition. It should be added that the term “alignment” means “расположение на одной прямой; установка на одном уровне; выстраивание в ряд; выравнивание; ориентация". The mentioned Russian variants of the lexical unit “alignment” are not used at all in the transfer of the terminological combination “electric hyperfine-structure alignment” to Russian.

All these facts given above were taken into consideration while teaching them to the language learners. Especially important was to acquaint master and post graduate Physics students with this information for progressing in their scientific career.

Discussions

The research revealed that in all simple one-word eponymous terms and an eponymous terminological combination it is impossible to replace the eponymous component with another arbitrary one, since the meaning changes and the connection with the information transmitted by the eponymous component of the term is lost. This shows the importance of the eponymous component in the terminological combination. The feature of indispensability gives reason to consider the eponymous lexical units of Physics fields as a term. This point of view is very important, since in linguistic scientific circles discussions are often held regarding the assignment of these lexical units to either terms stratum or nomenclature.

The results show that the same physics eponymous lexical units in Russian and English can have different structures, the identification of which can make a certain contribution to the terminological field of knowledge. There are also nonequivalent interpretations of the same terms (BARANOVA; MAKAYEV; SIGACHEVA, 2019; MAKAYEV; BARANOVA; SIGACHEVA, 2019) in the languages in question, the knowledge of which removes the difficulties in their perception and interchange from the original language to the target language.

The structural and semantic features of eponyms present some difficulties in interpreting the considered lexical units, not only for beginners to learn the language, which contains these eponymous terminological units, but also for language-experienced specialists. These difficulties may occur when working especially with multi-component eponymous terms and terminological combinations, as well as eponymous terminological combinations with several eponymous elements in their structure.

Conclusions

The analysis of the structural-semantic features of the eponymous lexical units of Physics fields in the English and Russian languages showed that:

1. In the field of knowledge under consideration there are one-, two-, and three- and multi-component eponymous terminological combinations. The eponymous element in two-component terminological combinations in both languages is located both in the preposition and in the postposition relative to the nuclear element and performs the function of determination. An exception is the term composite fermion in which the eponymous element is expressed by the derived term from the Fermi eponym and is nuclear. The terminological combinations considered are morphologically related to the main (nuclear) component - the noun - to the substantive.

The term of the original (English) language may be equivalent to the variant in the target (Russian) language. There are one-component non-comprehensible English terms expressed by common nouns, which in the Russian version acquire an eponymous element (etalon - интерферометр Фабри – Перо; fence – 1. направляющая планка 2. радиолокатор, использующий эффект Доплера). This phenomenon can also be found in the reverse version of the analysis: from Russian to English. There are terms that have several translation options in the target language (fermion - фермион, частица Ферми, ферми-частица; Kelvin – 1. по шкале Кельвина, по абсолютной (температурной) шкале 2. киловатт – час).

2. The most numerous are the two-component eponymous terms formed by the E + N model, where E is the eponymous component of the terminological combination expressed by a proper name or its derivative, N is the appellative component of the terminological combination expressed by a noun (Heusler alloy – сплав Гейслера; Brinell hardness – твердость по Бринелу). The translation of two-component eponymous terms is carried out in the same way as one-component terms, based on grammatical and semantic equivalence.

3. Three and multi-component eponymous terms in both Russian and English are rare (Poisson-Boltzmann equation – уравнение Пуассона-Больцмана, Vollmer-Weber growth mode – механизм роста Вольмера-Вебера, Gerasimov-Drell-Hearn sum rule – правило сумм Дрелла–Херна–Герасимова).

In the process of further development of the language of science, multi-component eponymous terminological combinations are supposed to replace shorter versions of truncated eponymous elements or they will be replaced by initial abbreviations (WKB method - Wenzel-Kramers-Brillouin method).

All these facts mentioned above were taken into consideration during the experimental teaching process that improved its effectiveness. A semantic analysis of eponymous terms using a sociolinguistic approach goes beyond the scope of linguistic research of terms and allows revealing the cultural component of the semantics of an eponymous term that reflects the history of science and the contribution of researchers to its development. The study of this issue may be the prospect of further research on the terminology of the Physics fields.

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REFERENCES

ABROSIMOVA, G. *et al*. Blended learning in university education. **Humanities & Social Sciences Reviews**, v. 7, n. 6, p. 06-10, 2019.

BARANOVA, A. R.; MAKAYEV, K. F.; SIGACHEVA, N. A. Diachronic tree of computer terms. **Journal of Advanced Research in Dynamical and Control Systems**, v. 11, n. esp. 8, p. 456-461, 2019.

GRINEV-GRINEVICH, S. V. **Terminology**. Moscow: Academy, 2008. 304 p.

KAKZANOVA, E. M. Nomenclature and eponymous terms: a review of opinions. **Bulletin of Moscow State Regional University**, n. 5, p. 21-25, 2010.

KAZARINA, S. G. Eponymous terms: advantages and disadvantages. **Scientific and Technical Terminology**, n. 1, p. 33-42, 1998.

KERBER, E. V. **Linguistic features of German-speaking economic terminology**: monograph. scientific. Ministry of Education and Science of Russia, OmSTU. Omsk: Publishing House of OmSTU, 2013. 148 p.

KLOSTER, A. M. Features of eponyms in the german terminology of engineering psychology. **Bulletin of the Samara Scientific Center of the Russian Academy of Sciences**, v. 16, n. 2, p. 416-419, 2014.

KOSTERINA, Y. E. **Eponymous units in the english terminology of physics Vestnik IGLU**. 2014. p. 76-82.

LEICHIK, V. M. Justification of the structure of the term as a linguistic sign of the concept. **Terminology**, n. 2, p. 5-16, 1994.

MAKAYEV, K. F. *et al*. Word building in the sphere of physics and its influence on the commonly-used vocabulary. *In*: INTERNATIONAL MULTIDISCIPLINARY SCIENTIFIC

CONFERENCE ON SOCIAL SCIENCES AND ARTS - SGEM, 5., 2018, Sófia. **Proceedings** […]. Sófia, Bulgaria: SGEM2018, 2018. p. 711-718.

MAKAYEV, K. H.; BARANOVA, A. R.; SIGACHEVA, N. A. Ways of vocabulary enlargement in the english sublanguage of physics. **Journal of Research and Applied Linguistics**, v. 10, p. 793-801, 2019.

NOVINSKAYA, N. V. **Eponymous names in the composition of modern russian terminology**: author. diss. ... K. Filol. Moscow, 1989. 20 p.

REFORMATSKY, A. A. What is the term and terminology (1959/1961). *In*: TATARINOV, V. A. **History of Russian terminology**. Classics of terminology: essay and reader. Moscow: Moscow Lyceum, 1994. p. 299-314.

SABIROVA, D. R.; KHANIPOVA, R. R. Innovative approaches to teaching and learning english as second and english as foreign language in multilingual education. **Humanities & Social Sciences Reviews**, v. 7, n. 6, p. 45-48, 2019.

SAKAEVA, L. R.; SIGACHEVA, N. A.; BARANOVA, A. R. Modeling of foreign language business communication concentrated training to master degree students. **The European Proceedings of Social & Behavioural Sciences**, v. 3, p. 736-743, 2017.

SHARAPOVA, T. N. Features of eponymous terms in the german terminology of bionics. **Lingua Mobilis**, v. 1, n. 40, p. 159-165, 2013.

SHELOV, S. D. **Nomenclature names as a class of scientific and technical vocabulary**: composition and functions. Saint Petersburg: St. Petersburg State University, 2007. 80 p.
SUPERANSKAYA, A. V. **Proper name in the language for special purposes**. Moscow: Moscow Lyceum, 1995. n. 2-3, p. 15-17.

TOLSTOY, D. M. *et al*. **English-russian physical dictionary**. 2. ed. Moscow: Owls Encyclopedia, 1972. 848 p.

VAKHRAMEEVA, V. V. **The eponymous terms in the english sublanguages of science and technology**: dis. ... cand. filol. Sciences: 10.02.04. Omsk, 2003. 143 p.

VINOKUR, G. O. About some phenomena of word formation in Russian technical terminology (1939). *In*: TATARINOV, V. A. **History of Russian terminology**. Classics of terminology: essay and reader. Moscow: Moscow Lyceum, 1994. p. 218-283.

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