Electronic Terminological Dictionary-Sourcebooks as an Innovative form of Information and Communication Technologies in Geoinformation and Cartographic Education

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Abstract. The aim of this work is to propose a program for the design, development, creation, implementation and use in the educational process of geoinformation and mapping education specialized electronic terminological dictionary-sourcebooks for the disciplines of the master's degree program training 05.04.03 "Cartography and Geoinformatics", including remote sensing and aerospace research and photogrammetry. In order to achieve the goal, the main directions and possibilities of the dictionary usage in educational process are outlined. Among the new terms, special attention is paid to terms focused on geoinformation and related technologies, as well as related geoinformation support for environmental management – information support for management decision-making and geoinformation and cartographic support for optimal management decisions. The possibilities of practical application of dictionaries in the educational process and the use of the experience of their development for the creation of dictionaries in related disciplines are considered.

Keywords: specialized electronic terminological dictionary-sourcebook, cartography and geoinformatics, information and communication technologies, innovations in education, geoinformation and cartographic education, master's program, teaching process

Электронные терминологические словари-справочники – инновационная форма информационно-коммуникативных технологий в геоинформационно-картографическом образовании

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Аннотация. Цель данной работы – предложить программу проектирования, разработки, создания, внедрения и использования в учебном процессе геоинформационно-картографического образования специализированных электронных терминологических интерактивных словарей-справочников по дисциплинам магистерских программ направления подготовки 05.04.03 «Картография и геоинформатика», включая дистанционное зондирование и аэрокосмические исследования Земли и фотограмметрию. Для достижения поставленной цели намечены основные направления и возможности использования словаря в учебном процессе. Среди новых терминов особое внимание уделено терминам, ориентированным на геоинформационные и смежные технологии, а также связанному с ними геоинформационному обеспечению управления

природопользованием – информационной поддержке и геоинформационно-картографическому обеспечению принятия оптимальных управленческих решений. Предлагаемый вариант терминологического электронного интерактивного словаря-справочника отличается от известных аналогов обильным использованием иллюстративных и картографических материалов, мультимедийных элементов, а также включением транскрипции терминов и объяснением их правильного произношения, переводов на иностранные языки, что дает возможности для достижения новых целей и имеет методическую значимость. Для автоматизации процесса его создания предполагается разработка специального универсального шаблона. Уникальный словарь-справочник позволит учащимся самостоятельно эффективно ликвидировать пробелы в знаниях или, наоборот, углубить свои знания в интересующей их области. Кроме того, его можно использовать при организации и проведении научно-исследовательской работы и/или подготовке магистерских диссертаций. Рассматриваются возможности практического применения словарей в учебном процессе и использования опыта их разработки для создания подобных технологий в смежных учебных дисциплинах.

Ключевые слова: специализированный электронный терминологический интерактивный словарь-справочник, картография и геоинформатика, информационно-коммуникативные технологии, инновации в образовании, геоинформационно-картографическое образование, магистерская программа, учебный процесс

Introduction

In the successful development of any educational and/or scientific discipline, the study of its history and conceptual (terminological) apparatus plays a significant role. The development of science needs constant meaningful (respectively – terminological) modernization – the introduction of new terms, clarification and change (expansion or contraction) of the content of the established ones, clarification of the relationship between the operated terms and their variants, as well as variants of their definitions [Lim at. al., 2019; Amador-Cruz at al., 2021; Gunia, 2021; Frančula, Lapaine, 2022]. At the same time, the need to achieve different degrees of unambiguous use of both new introduced and established, familiar terms play a vital role.

Speaking of the first group – new terms – as an example, the terms focused primarily on new geoinformation and related technologies (remote sensing and aerospace research, photogrammetry) and related geoinformation support – primarily geoinformation technologies in environmental management and geoinformation and mapping support for optimal management decision-making [Koshkarev, 2000; Eprincev, Chepelev, 2008; Kryshchenko et al., 2013; Markova, Tikunov, 2022; Yamashkin, Yamashkin, 2022].

The special importance and necessity of wide application of geographic information systems and GIS technologies in various branches and fields of science, engineering, technology and production is now generally recognized and is an immutable fact. The development of applied GIS, the introduction and use of geoinformation and related technologies [Teslenok, 2014a; Teslenok, Teslenok, 2015; Teslenok, 2016; Alferina, Teslenok, 2019], GIS mapping and modelling [Teslenok, 2014a; Teslenok, 2014b] are designed to increase their effectiveness. The accounting of natural conditions and resources and the solution of problems of their rational use should be based on a sanctioned system that allows continuously in an interactive mode to make the necessary adjustments, receive relevant information and make the necessary calculations [Teslenok, 2016; Alferina, Teslenok, 2019].

Therefore, this aspect is given priority attention when studying the disciplines of the mandatory part of the curriculum and the part formed by the participants of educational relations in the

Master's degree program 05.04.03 "Cartography and Geoinformatics" (profile "Geoinformation and cartographic support of sustainable development of territories") of the Institute of Geoinformation Technologies and Geography of N.P. Ogarev National Research Mordovian State University. At the same time, an important role is played by students' independent work with concepts and terms and maximum possible use of illustrative, cartographic materials, animation elements, video and audio materials and other multimedia elements, collectively referred to as hypermedia, the joint use of which makes it possible to obtain an information source of complex structure [Teslenok, Chekurova, 2014; Teslenok et al., 2015]. There is no doubt that the future belongs not to traditional but to innovative educational products - terminological electronic resources, dictionaries, glossaries, thesauruses, educational systems, databases and knowledge banks and other digital educational resources [ГОСТ 7.24-2007; ГОСТ 7.25-2001; ГОСТ 7.0.83-2012; Teslenok, Chekurova, 2014; Teslenok et al., 2015].

Objects and methods of research

The methodological and substantial novelty and innovation of the author's approach consists in the following aspects. The proposed version of the electronic terminological dictionary-sourcebook differs from the known analogues by the maximum use of illustrative, cartographic materials, multimedia elements, which significantly expands the possibilities and methodological significance, by including transcriptions of terms and explanation of their correct pronunciation, as well as translations into foreign languages [Lisetskii, Solov'ev, 2002]. To automate the process of creating an electronic dictionary and reference book, a special form-template for universal use will be developed.

With the advent of computer technology, a new type of dictionary has emerged, called electronic dictionaries. These are dictionaries on a computer or other electronic device. Compared to traditional dictionaries, they have a number of obvious and significant advantages. Until recently, the only disadvantage has been localization and, consequently, strict binding to the computer, and the consequent limited availability. But the increasing pace of computerization and the development of network technology and mobile equipment (above all technology and communications) have eliminated it.

Dictionaries, as mere digital copies of traditional editions, have significant disadvantages and, above all, the main disadvantage is the obsolescence of traditional dictionaries [Coetzee et al., 2021]. Electronic dictionaries can be updated as quickly as necessary, especially when additional definitions of terms appear. Traditional dictionaries may contain errors and inaccuracies. In an electronic version, it is easy enough to make the necessary changes and corrections, including changing the structure of the dictionary entry. The advanced search system in them very easily overcomes the key contradiction of the traditional ones: the increasing complexity of the growth of information and the development of its scientific apparatus. An important advantage of electronic dictionaries is the availability of transcription and the possibility to pronounce the term with the correct verbal accent (with the help of a sound synthesizer or a voiceover by a speaker with a reference pronunciation) [Balalaieva, 2020; Mehriniso, 2021; Mokhiyakhon, 2021].

Results and discussion

In this regard, the project for the design, development, creation, implementation and use in the educational process of specialized terminological electronic interactive reference dictionaries in academic disciplines as a mandatory part of the curriculum for the master's program ("History, theory and methodology of cartography and geoinformatics", "Modern communication technologies", "Computer technologies in cartography", "Space and geoinformation technologies in sustainable development", "Modern problems of cartography", including the disciplines of the project module "GIS in atlas mapping" and "Project management in professional activities") and the part

formed by the participants in educational relations ("Automation in thematic cartography", "Geodesic support for sustainable development of territories", "Land resource mapping", "Regulatory and technical and legal framework for cartography and geoinformatics", "Sustainable development of geosystems and their management", including the discipline of the project module "Design, creation and operation of geoinformation systems", elective disciplines "GIS in cadastral systems", "Experience in the creation and use of GIS", "Adaptive information and educational technologies", "GIS in environmental geoinformation mapping", "Geoinformation mapping in territorial planning and design", "Geographical bases of environmental management", "Space monitoring of environmental management", a block of individual educational trajectories "Monitoring of landscape and geoecological systems", "Forecasting the development of geotechnical systems", "Cadastral registration of real estate objects", "Planning and organization of land management and cadastral work", "Methods of environmental management", "Modern problems and methods of geographical science", "Geoinformation systems in tourism", "Multimedia and computer design in cartography", "Digital methods for processing and analyzing data from remote areas and optional disciplines "Web technologies" and "Modeling and spatial analysis by means of GIS"). Such reference dictionaries are oriented to the maximum extent to the use of the HTML hypertext markup language, the system of hypertext links, illustrative, cartographic materials and multimedia elements. Accordingly, the tasks that need to be solved to achieve it are the development of technology for creating electronic terminological dictionary-sourcebooks on the example of a specific academic discipline, as well as the development and creation, through practical software implementation, of a special template form of an electronic terminological reference dictionary, which allows automating the process of its formation. and promote the resulting innovative product as quickly as possible.

The created educational product should fully comply with the educational standards of the HEI and fit into the general concept of its development, primarily in the framework of:

– introduction of new learning technologies into the educational process, including the creation of a digital educational environment (modern digital educational technologies, electronic textbooks and teaching aids, etc.);

– improvement of teaching and methodological support of the educational process in order to enhance the quality of higher education: formation of modular programmers, ensuring the construction of flexible individual learning paths, introduction of credit-module system in basic vocational education programmers, providing remote support for all vocational education programmers;

– development of innovative approaches to the organization of educational process; development of methodological recommendations for the organization and implementation of innovative educational activities;

– development of educational programmers and technologies aimed at training, retraining and professional development of highly qualified specialists;

– expansion of Master's training in partnership with leading Russian and foreign universities, industrial enterprises, organizations and institutions of social sphere in order to integrate into the world scientific and educational space.

The experience of creating analogues of the proposed educational product in other universities (including foreign ones) is known. However:

– these are traditional thesauruses and dictionaries with minimal changes in terms of their adaptation to electronic form, without significant enhancement of their capabilities and methodological significance of illustrative, cartographic materials, multimedia elements;

– no experience in the development of a template-form that would largely automate the process of creating an electronic terminological dictionary has been identified;

– the methodological issues of using such educational products in the educational process are poorly covered.

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In the process of developing and creating an innovative educational product, it is planned to make maximum use of previously developed teaching and learning material. A series of completed coursework and final qualification papers on the relevant topic are of great importance. In addition, a complete list of terms used in the study of relevant courses has been compiled, and at least five definitions from different sources have been selected for each of them with their output data recorded. Partially selected multimedia material (illustrative and cartographic) is available, greatly enhancing the comprehension of the text traditionally used in glossaries (table).

Expected results of design, development, creation, implementation and use in the educational process of the electronic terminological dictionary-sourcebook

Ожидаемые результаты проектирования, разработки, создания, внедрения и использования в учебном процессе электронного терминологического словаря-справочника

Result	Indicator	Source of verification
Improved student learning outcomes	Quality of education and other student learning outcomes	Results of interim and final evaluations of students
Enhanced motivation of students	Percentage of students interested in learning the discipline	Results of surveys and questionnaires
Faster and better formation of the system of universal and specialized general professional and vocational competences of students	Speed and quality of formation of the system of universal and specialized general professional and vocational competences of students	Results of interim and final attestation of students
Sustainability and viability of the obtained project results	Duration (number of years) of operation and use of the dictionary in the educational process	Data from reports, surveys and questionnaires

The university has information system technologies, including geoinformation systems, computer classrooms with Internet access and electronic information educational environment [Электронная информационная ..., 2022], modern multimedia systems, projection equipment with multimedia projectors and presentation screens, which are widely used by all participants in the educational process. It is planned to modify the obtained product with the creation of a version available for mobile applications.

The creation and software implementation of an appropriate template form is required in order to enable a maximum degree of automation of the dictionary-record creation process.

The educational product is the electronic terminological dictionary-sourcebook with the largest number of concepts and terms used in the study of the relevant scientific field and/or academic discipline, the maximum use of hypertext technology (hypertext markup languages HTML and cascading styles CSS, hypertext links system) and multimedia elements [ГОСТ 7.25-2001; Starkov, Alekseeva, 2015; Teslenok, Chekurova, 2014; Teslenok et al., 2015]. Concepts and terms are placed in thematic sections and subsections at different levels, which provides a structured information in the dictionary.

Providing the possibility to use sub-section titles of different levels in combination with nested concepts to build word combinations is one of the main functions of fast text entry in the fields of screen forms. The combination of section titles and a nested term can form a complete semantic expression.

The information presented in the dictionary has a tree structure. Each element in a dictionary can be of one of two types - a section title with sub-levels and a term without additional sub-levels. The thematically most important (general) concepts are included in the upper-level section titles, and their sub-levels contain elements that develop and specify the meaning of the expression.

The structure of the electronic terminological dictionary-sourcebook is a set of vocabulary entries, the content of which corresponds thematically to the sections of a scientific field or an academic subject. Each entry corresponds to a specific field of the mapping form and contains a certain set of terms. The titles of the entries and the names of the fields are the same. This ensures navigation through the vocabulary when the vocabulary entries change from one field to another [Chepik, 2016].

The platforms for placing specialized terminological electronic interactive dictionaries on academic disciplines at the initial stage are the Electronic Information Educational Environment of the N.P. Ogarev National Research Mordovian State University [Электронная информацион-ная..., 2022] and the website for teaching materials by S. A. Teslenok [Сайт учебно-методиче-ских ..., 2022].

The terminological electronic dictionary, which is an information retrieval thesaurus, is developed within an automated information system, taking into account the rules of development, composition and presentation form, structure of the content regulated by the relevant standards [ГОСТ 7.24-2007; ГОСT 7.25-2001; Arzamasceva, 2014].

The results, indicators and sources of validation (methods of verification) expected by the results of design, development, creation, implementation and use in the educational process of master's degree program 05.04.03 "Cartography and Geoinformatics" (profile "Geoinformation and cartographic support of sustainable development of territories") are presented in Table 1.

Conclusion

The hypertext technology underlying the educational product is widely used in educational systems, distance learning, Internet, database systems, etc., which emphasizes the relevance of the research.

The possibility to design, create and use own dictionaries in the process of undergraduate education can become an effective tool for developing students' universal and specialized socio-personal, general cultural, general scientific, professional and vocational competencies. The demand for such innovative developments on the part of higher education institution and educational community is determined by the need to increase students' motivation.

The use of this educational product in traditional education is possible in the presentation of new material, practical work, consolidation of the studied material, implementation of knowledge control, and independent work of students. The proposed educational product primarily provides an opportunity to use it in distance learning.

The use of the electronic terminological dictionary-sourcebook can enable students to effectively fill existing knowledge gaps on their own or, conversely, to deepen their knowledge in their field of interest. In addition, there are opportunities for its use in organizing and conducting research work and/or preparing Master's theses.

The acquired experience will allow applying the technology of designing, developing, creating, implementing and using in the educational process of specialized terminological electronic interactive dictionaries and reference books in other related subject areas, such as aerospace Earth studies; photogrammetry; land use planning, cadastre and land monitoring; geomorphology and paleogeography; physical geography, soil geography and landscape geochemistry; geoecology; economic, social, political and recreational geography, etc.

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