

METHODOLOGICAL FUNDAMENTALS FOR THE CREATION OF A MODERN TEXTBOOK ON THE NATURAL SCIENCES CYCLE SUBJECTS

O. M. Topuzov,

Doctor of Pedagogical Sciences, Professor

The article justified methodological basis for the creation and operation of a textbook on the natural history cycle academic subjects in the educational process of modern Ukrainian secondary schools, which cover the meaningful components of textbooks and methodical bases of operation. Special attention is paid to the methodological basics of using the electronic version of the textbook, outlined the prospects for media supply educational information in the process of studying the natural history of the cycle. The concept of a new generation of textbooks includes:

1. Formation of the key and subject competencies that can meet the challenges, and provides objective of its result.

2. Formation of the maintenance of natural history knowledge as a representation of the territorial organization of society at the level of «territory – the time – a man» signs of ethno-landscape business. Structuring educational material (text component) textbooks on geography provides summary and explanation of the fundamentals of science, formulation, definition and explanation of terms and concepts that can make the generalization that the principle of presentation of textual material must activate cognitive activity of students.

The publication focuses on the development of new learning technologies, which generates the necessary information environment subject interacts with the training manuals used at the school level, the natural history education.

Keywords: *natural history objects running book, methodical bases of creation of textbooks, electronic textbooks.*

A textbook/a handbook for the secondary school is an educational text as a direct result of the author's individual or collective creativity, which, in its turn, is differentiated into subsystems and elements. Since a textbook/a tutorial is of a monographic nature, in its structure, the components that are correlative to the logic of human thinking are distinguished. They are the following: introduction (rationale), main body (the didactically processed theoretical and applied materials in a certain field), conclusions and the outline of the further prospects of the scientific theoretical and applied problems that have been raised in the content.

The architectonics of a tutorial/a manual displays all possible aspects of its construction in understanding the structured integrity in a certain way. In the process of the development of the textbooks electronic presentation form, the terms «hypertext» and «hypertext systems» are becoming more and more popular.

In the literature on the textbook theory, the attempts to form a system of the basic requirements for the didactically processed educational materials clearly are constantly made: 1) following the principles *from the known to the unknown, from the simple to the complex, from the easy to the difficult, from the certain to the abstract, from the consideration in general to the detailed analysis* etc.; 2) the further steps are based on the previous ones and the previous issues are comprehended by means of the further ones; 3) the sensitive precedes the mental; 4) material primarily involves a question rather than learning by heart only; 5) each rule is accompanied by a sufficient number of examples illustrating the various ways to apply to it; 6) examples are explained by rules; the rules are accompanied by the examples; 7) the representation of the educational information subject is not offset by the minor issues; 8) the represented material has references to the authoritative sources or logical proofs.

Taking into consideration the functional complexity and importance, the conclusion is the generalized sub-system of a textbook/a handbook by the level of its theoretical and methodological development.

At the modern stage of creating textbooks, the problems of the methodological fundamentals for the creation and the functioning of textbooks on natural subjects require to be solved.

The purpose of the article is to justify the methodological fundamentals for the creation and the functioning of a textbook on natural subjects in the educational process of the modern homeland secondary school.

Creating a textbook is ensured on the didactic basis (textbook as a teaching tool, a modern didactic system element) and the methodological basis (a textbook as an informational model of studying a certain subject/discipline). The peculiarities of creating a modern qualitative textbook lies not only in the use of the topical achievements of didactics and methodology, but also in the necessity to take into consideration the didactic achievements of prognostics and prognostics studies in the methodology of teaching the corresponding subject. This is predetermined by the quite rapid changes in the practical activity of humanity, the fast academic knowledge acquirement which is peculiar for the contemporary scientific and technological revolution, the diffusion of the ICT in modern society. For the purpose of preventing a textbook from not only becoming outdated in the process of creation, but also losing its relevance during quite a long period of time, we should consider both the modern opportunities in learning the subject and its prospects, make a full use of the prognostic nature of scientific knowledge, which will be presented in its content in the didactically processed form. This leads to the definition of the new concept and the improvement of the theoretical and the methodological fundamentals of creating textbooks, which, in our opinion, will be the results of the corresponding special researches.

Taking into account the abovementioned issues, the methodological fundamentals for creating a modern textbook on the natural sciences cycle subjects are enriched by the corresponding ideas, approaches, principles, methodologies, etc., associated with the pedagogical and the didactic prognostics.

Since a modern textbook on geography as a multifunctional learning tool not only represents the content of a particular school geography course, but also is a specific model of the comprehension of the didactically processed content of the natural sciences area by the semantic characteristics, the concept of developing a new generation of textbooks significantly changes. This concept is considered by us as a system of scientific views on the idea of creating a textbook, goals and objectives, structure and conceptual principles for the selection of units to be represented in it, the basic principles for the terminological lexicography units, and structured learning. Structuring the curriculum should coincide with the scientific criteria (meeting the requirements of the educational system of school discipline, taking into account the achievements of the scientific schools at the present stage of the natural thought development) and the methodological one (the correspondence of the textbook content to the requirements of the educational system of the school discipline, in other words, it is necessary to provide the methodological system of working with a textbook, the independent work and the practical work organization, the task to observe and to solve the subject problems etc.).

The concept of a manual is represented in the *prospectus* of the future, which is presented as a draft in the specialized periodicals for the scholars to discuss. This prospectus will be prognostic, ensure the achievement of all purposes and architectonics of a textbook, and determine the way to create it.

The abovementioned prospectus underscores the following aspects:

1. the need for the design of an appropriate textbook;
2. the history of the design of the similar textbooks, including the analysis of their completeness, adequacy of the language units description, the appropriateness of the selected structure;
3. the purpose, the nature and the objectives of a manual, the terms character may be represented in the section or in the part of it;
4. at present, the empirical basis or the text one, the vocabulary, the empirical base of the educational area textbooks must include the electronic text resources.
Text body is the representative training texts converted into electronic form, normally organized, and processed in a program way, which is aimed at studying, analyzing and technological using.

5. the overall structure of a textbook (macrostructure), including the creation and the organization of the content components, vocabulary entries to the terms given for comprehension.

6. visual and graphic text typography. It must ensure the adequate quantity and quality of illustrations that would fulfill not only an information function of illustrating the considered natural processes and phenomena (visual picture), but also a developing one that enables consideration an illustration as a conceptual image, which allows one to ask questions, to state the problem with the use of the questions, forms the abilities to perform mental operations (analysis, comparison, comparing, finding geographical causation, etc.). From the standpoint of the methodological principles of developing a textbook, we find the change in the

figures functions which, on the one hand, explains the issues that are shortly expressed in the text, and on the other hand, they are the sources of knowledge and contain the information which is provided in the text component not in detail or is even, contains some intellectual contradiction.

The textbooks on the natural sciences area of a new generation are marked by the focus on the development of the key and the subject geographical competencies, which give the individual an opportunity to apply their knowledge in real situations in future.

Taking into consideration the abovementioned issues, we define *those methodological principles of designing the geography textbook of a new generation that allow the fulfillment of prognostics tasks of the modern natural sciences studies:*

1. *formation of the key and the subject competencies*, the mastery of which will give a pupil an opportunity to solve practical problems, foresee the objective of the corresponding activity and its results. The concept of a competence reflects the integral nature of the academic results at any level and in any aspect. The pedagogical and the psychological thought represents the concept of the holistic image of the world, which we associate with the pupil's subject competence. The integrity explicate is the subordination of all elements that are formed by it, the patterns which are universal and common to all the knowledge elements.

For the worldview, these peculiarities form the basis of the scientific thought paradigms in order to become a basis for the integrity of knowledge about the world and the solution of the scientific problems that arise. If a competence reflects the integrity and the integrative education essence at any level and in any aspect, the image of the world is the starting point and the result of any cognitive activity.

In the pupils' geographical education, the world cognition is important by means of the natural worldview that is constituted on the provisions on the relationship of culture and civilization, creative sociocultural ethnos system, its national determination. All these issues help to interpret the image of the world predetermined by the pupils' competence as integrity and the integrative nature of the academic outcomes with the worldview, the formation of which is a quite a long process.

This approach can be most efficiently and effectively refocus education on the upbringing a human as a personality when the main criterion for the educational space determination is a wide range of educational and teaching activities in the interplay with the political, the informational, the cultural, and the ethnic areas, associating the academic space with the social and space phenomena.

In this way, geographical education is understood as a quality indicator of the pupils' subject competence; it is a purposeful, systematically organized process of the interdependence of the activities of a teacher and a pupil in the classroom, that provides the pupils' effective mastering the system of geographical knowledge (based on integration), the skills and the abilities of geographical activity for the formation and the development of pupils' specific geographic concepts, laws,

categories as well as their geographical consciousness (geographic literacy) with the gradual formation of the pupils' certain personality traits that contribute to the success of their further training and other activities.

Subject geographical competence as an integrated result of the pupils' academic activities is formed primarily on the basis of the mastery of the comprehensive secondary education content in the general sense, geographical content (in the objective sense), the geographical content with the local history education component.

The pupils' level achievements assessment is particularly important due to the fact that the school geography content comprises not only the provision of the set of geographical knowledge as well as the formation of the skills and abilities of the primary school pupils but also the formation of a certain level of *geographic competence as a general ability based on the geographical knowledge, practical expertise and personal traits formed by means of geography learning*.

2. Formation of *the natural sciences knowledge content* as an idea on the territorial (spatial) organization of the certain social environment at the level «territory - time - human», the features of the ethnic, landscape and economic integrity within which there is the interrelationship between the natural conditions, the natural resources and the ethnic group, the ways of household managing and spiritual values.

The content is structured under the principle of the delimitation of the empirical and the theoretical blocks: 1) empirical knowledge (concepts and terms - natural components, physical and geographical, social and economic, social and cultural phenomena, facts of reality); 2) theoretical knowledge (laws, theories, hypotheses - the natural objects' interrelationship, processes, and phenomena, their structural characteristics, features and patterns of development).

We would like to notify that in the geography textbook of a new generation, a special attention is paid to the local geography education, which promotes the pupils' national identity that is found by us as the avid studying of culture, history and the native land nature.

Mastering the local geography education contributes to the comprehension of the harmonious interrelationship between the universal and the national socio-cultural existence, which is widely expressed in the national culture that includes the experience of the human thought understanding.

Implementation of the local geography principle makes it possible: 1) to extend the concept of the native land territorially; 2) to stimulate the role of the pupils' theoretical thinking; 3) to ensure an optimum integrity and the interrelationship of the pupils' local geography searches in the classroom and in the out-of-school time.

The implementation of the local geography approach to the development of a new generation of a geography textbook promotes: the effective regional policy provision; the reproduction of the historical and geographical memory of a nation; the return to the scientific inheritance of the prominent geographers, researchers and chroniclers of their native land, the study and the popularization of the input

of the homeland scholars, geographers, ethnographers, foreign researchers who have studied Ukraine; the rational use of natural resources; the expansion of the natural reserve fund, ensuring the pupils' spiritual culture.

In correspondence with the general methodology of a model of a textbook of a new generation, the structuring of the local geography material in the form of a system of the possible epistemological components make a certain contribution to the holistic understanding of a modern scientific worldview. The corresponding components can be considered as the content and procedural lines of the development of the ideas on the social and natural worldview according to the educational process structure, which is particularly important from the standpoint of the continuity and the sequence of the regional natural sciences education. Therefore, the analysis of each component and their system is necessary in choosing the specific content of the educational material at all stages of the school local geography education.

3. *Structuring the educational material (text component)* of the geography textbooks provides explanation and presentation of the scientific fundamentals (ideas, opinions, concepts, laws, theories, etc.), formulation, definition and explanation of terms and concepts, explanation, generalization and making conclusions; that is the reason why the principle of the texts presentation should intensify the pupils' cognitive activity. The balance between presentation and explanation will be organic when the *challenging principle* of the educational material structuring is applied; it allows you the active implementation of the innovative methods and forms of work in order to apply the acquired knowledge and skills practically, explain the phenomena, conduct researches and comprises not only mastering the scientific knowledge results, but also mastering the process of obtaining them that improves the pupil's cognitive activity, develops their creative skills, and promotes the acquirement of knowledge, abilities and skills. It provides an opportunity to focus on the development of the pupil's thinking.

Correspondingly, the ratio of *the challenging and the creative* tasks and problems with their simultaneous complications varies upward. Challenging tasks include some intellectual controversy in violation of the pupils' more or less formed geographical causation, initiate some searches as well as various mental activities whereas creative tasks are aimed at the formulation of estimates and making conclusions, synthesis of new knowledge by the pupils who do not have any unambiguous, predefined responses and solutions. The successful fulfillment of the challenging and the creative tasks is closely linked with the linguistic correctness when the language of geographical tasks reflects the taught concepts within some category and reproduces the logic of the arguments for the studied or the analyzed natural phenomena or processes. Geographic textbook language is a means of cognition and description of natural phenomena, processes, properties of matter and geographical objects (terms, concepts, keywords, geographic problems etc.). Therefore, in the process of the geography textbook content development, it is noteworthy to form the content of the «lingual» knowledge and skills for the

school geography course at the level which is sufficient for the conscious mastery of knowledge and skills prescribed by the curriculum.

Any problem appears in the form of a question. This question stimulates the cognitive activity of an individual, encouraging his/her for some mental activities (analysis, synthesis, comparison, generalization, analogy, proof, refutation, etc.). In order to determine the conditions which make an issue challenging, the acts or operations necessary by the pupils' formulated questions should be found out. It is not so much the result as the nature, the stages and the chains of the cognitive searches which are related to solving problems that have arisen characterize the problematic issue. A pupil must find out the response only after realizing the problem, not in the process of making certain calculations by a known algorithm, without taking into consideration its essence (in the case of the practical problems and questions).

The highlighted positions are in a close relationship that have been taken into account by us in the process of designing a textbook: the more formed the pupils' speech components of mental operations are, the more generalized these operations become that provides the rapid, and partly, the creative solutions to the challenging issues:

Tasks. *Comment on the statement that «the development of the economy is always striving for the most efficient combination of the social and the effects.» Are the living standards as a factor in the local production increasing? How to plan the improvement of the lives of people so that it is simultaneously contributed to the equalization of the economic development of different regions of our country? Is it possible to ensure it?*

Tasks. *Finnish call their forest «green gold». Prove the correctness of this name.*

In Finland, coniferous forests cover 2/3 area, and foliage ones 3.1; however, in the result of economic activity, this ratio is disturbed. Why have the timber reserves declined by 10% in recent years? How do the woodcutters move in the winter forest? (By skiing). Forecast the ways to restore the natural resources of «green gold» in the country.

Tasks. *By 1970, in Ukraine and the CIS eight thousand of the waste treatment plants were put into operation. How does it help solving problems of the Dnieper River, Lake Ladoga, Lake Baikal, Aral Sea and others?*

Tasks (local geography). *In your locality, at 0 ° C, in each cubic meter of air, 4 kg of water are placed. At the same time in Ashgabat at +20 ° C, this figure is 8 grams.*

Determine where the air is more humid.

A textbook / a handbook on natural sciences, in which clearly designed the content components and the means of their implementation are clearly designed, the organization enables the pupils' systematic learning. The developed textbook of a new generation should be accompanied by the typical educational information programs, providing for the work on a PC. It is not only a new generation of

textbooks, and the development of the new learning technologies, which form the necessary information environment (under the conditions of the maximum interaction and continuity with the series of textbooks used at the level of school natural sciences study).

The results of forecasting the geographical education development justify the increase in the importance of ICT and electronic aids created on their basis in its implementation. It makes the question of the technical use of the textbook, the production and the use of electronic publications topical. The difference between this edition and the traditional one in its new features and capabilities: rapid posting of information, converting a reader into a participant who may participate in the collective textbook creating or become a critic; the possibilities of a hypertext and plot variability, the broad discourse of the design possibilities when the text and its presentation is focused, and the author becomes more similar to the author-director (the educational electronic edition will provide the authors an opportunity to self-express).

It refers to the development of:

1) an electronic geographical adviser that allows the efficient use of the computer multimedia capabilities, which can simultaneously combine both figurative elements of geography, and the text one, namely, the development of the structure and the content of such educational geography software as: «Library of the electronic visual aids. Geography. 7-11 grades («JSC Malva», O. M. Topuzov), »Virtual geographical laboratory»; «Statistical and stochastic mathematical methods in geography» (V. M. Samoilenko, O. M. Topuzov, TM «Prodigy children»);

2) e-learning tools: electronic presentation (for the specific topics: «National Park Holy Mountains», «Natural areas», «Flora and fauna of Ukraine», «The role of the Ukrainian scholars in studying the nature and economy of Ukraine»); the educational series for independent and individual work («Teaching the electronic guide, Grade 7, » «Teaching software tool «Physical Geography of Ukraine, Grade 8»; «Electronic Teaching kit «Geography 7th-11th Grades» (by O. M. Topuzov, O. V. Kokhan).

Taking into consideration the analyzed illustrations qualities offered in the modern textbooks, which perform not only informative, but also conceptual functions and contribute to the solution of problems or tasks, it is noteworthy to emphasize that at the present stage of development of the theory of creating a textbook, is the introduction of three modes of the interactive representation of the animated figures and tables that significantly enhance the effectiveness of the didactic visualized information is significant.

Let's outline the prospects for the further development of the raised problems.

In the further scientific studies, the following areas need to be considered:

- the development of the general concept of the geography textbooks of a new generation in the system of the continuous natural sciences education for the purpose of the solution of the pedagogical problems related to the development and acquirement of knowledge in the natural sciences education;
- the professional training of teachers to use in practice the new textbooks,

based on the challenging way of the educational material, including the use of the e-learning of geography;

- improvement and creation of the reliable instruments and quality assurance for the improvement of the pupils' core competencies and subject-matter competence in the study of geography;

- continuity in the formation of the core competencies and subject competence of the secondary school pupils in the process of teaching Geography in the educational process within the main school;

- development of the electronic teaching systems for the profile of the secondary school under the programmatic content and concept of geography textbook for the specialized schools.

In conclusion, the concept of a new generation of textbooks is consistent with the educational objectives set in the Geography curriculum and should be a priority not only for the researchers, educators, and geographers, but also the experts from the other disciplines.

References

1. Zahalna metodyka navchanna heohrafiї : pidruchnyk / O.M. Topuzov, V.M. Samoilenko, L.P. Vyshnikina. – K. : DNVП «Kartohrafiya», 2012. – 512 s.

2. Nadtoka O. F. Heohrafiya : pidruchnyk dla 9 kl. Zahalnoovitnikh navchalnykh zakladiv / O. Nadtoka, O. Topuzov. – K. : Svitznau, 2009. – 224 s.

3. Topuzov O.M. Heohrafiya materykiv i okeaniv : pidruchnyk dlya 7 kl. / O. Nadtoka, O. Topuzov: Svit znau, 2008. – 292 s.

Література

1. Загальна методика навчання географії : [підручник] / О. М. Топузов, В. М. Самойленко, Л. П. Вішнікіна. – К. : ДНВП «Картографія», 2012. – 512 с.

2. *Надтока О. Ф.* Географія : [підручник для 9 кл. загальноосвітніх навчальних закладів] / Олександр Федорович Надтока, Олег Михайлович Топузов. – К. : Видавничий дім «Світ знань», 2009. – 224 с. : іл., карти.

3. Географія материків і океанів : [підручник для 7 кл.] / О. М. Топузов, О. Ф. Надтока, Т. Г. Назаренко, Л. П. Вішнікіна. – К. : Видавничий дім «Світ знань», 2008. – 292 с. : іл., карти.

Топузов О. М.

МЕТОДИЧНІ ЗАСАДИ СТВОРЕННЯ СУЧАСНОГО ПІДРУЧНИКА ІЗ НАВЧАЛЬНИХ ПРЕДМЕТІВ ПРИРОДНИЧОГО ЦИКЛУ

Обґрунтовано методичні засади створення та функціонування підручника з навчальних предметів природничого циклу в навчальному процесі сучасної української загальноосвітньої школи, які охоплюють змістовні складові створення підручника та методичні основи його функціонування. Окрему увагу приділено методичним основам використання електронного варіанту підручника, окреслено перспективи медійної подачі навчальної інформації в процесі вивчення предметів природничого циклу.

Ключові слова: природознавчі предмети, методичні основи створення підручників, електронні підручники.

Топузов О. М.

МЕТОДИЧЕСКИЕ ОСНОВЫ СОЗДАНИЯ УЧЕБНИКА ПО УЧЕБНЫМ ПРЕДМЕТАМ ПРИРОДОВЕДЧЕСКОГО ЦИКЛА

Обоснованы методические основы создания и функционирования учебника по учебным предметам природоведческого цикла в учебном процессе современной украинской общеобразовательной школы, которые охватывают содержательные составляющие создания учебника и методические основы его функционирования. Отдельное внимание уделено методическим основам использования электронного варианта учебника, очерчены перспективы медийной подачи учебной информации в процессе изучения предметов природоведческого цикла.

Ключевые слова: природоведческие предметы, учебниковедение, методические основы создания учебников, электронные учебники.