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Analysis

Textbooks for biology applied in schools in Russia

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Abstract

This article describes textbooks that are used in the teaching of biology in schools in Russia. The characteristics of designing biological programme content are presented. The school textbook, as a book, consists of a system of texts, illustrations, apparatus for acquiring knowledge (methodical apparatus) and elements for orientation in the presented contents. In the textbook of biology, different types of texts are distinguished: basic, additional, explanatory. In Russia, biology textbooks for the school public more than ten publishers. A set of biology textbooks, ensuring the continuity of the study of biology in grades 5-9 (10-11) is called the subject line. Authors of different subject lines of textbooks differently select and structure the content of biological education. Depending on the approach to the structuring of the educational material, all subject lines of textbooks can be divided into two groups (system-structural approach and functional approach). These approaches can have a linear or concentric content structure. Each teacher has the right to choose from the variety of subject lines of biology textbooks those that most satisfy his needs.

Keywords*: biology textbook, programme content, functional approach, linear structure of biological programme content, concentric structure of biological programme content.*

Introduction

A school biology textbook/learning book, contains a certain amount of biological programme content that reflects the current level of achievement in biology and is intended to be mastered by students (Sumatokhin & Kalinova, 2016).

School textbooks for biology have information, transformation, systematization, consolidation, control, self-education, integrative, developmental and educational role. The information role points to the content and activities that must be formed in students in biology teaching (Sumatokhin, 2004).

The transformation role implies the transformation (selection and grouping) of scientific knowledge in the logic structure of assimilation of knowledge: understanding - memory - application. The systematization function aims to form a student's biological knowledge system. The function of consolidation and self-control determines the legitimacy of acquiring knowledge and facilitates the rational organization of learning activities. The self-

education function aims to form the need for independent learning and the ability to properly organize cognitive activities. The integration function unifies within a single system an individual / fragmented information obtained from the media and life experience. The developmental-educational role is connected with the development of pupil's ability to find information and educate them selves (self-study).

The programme content of the subject Biology, which is in the textbook, is called educational material. It consists of scientific concepts, biological expressions / terms and biological facts. The scientific terms in the textbook are divided into 3 groups. The first group consists of those concepts that are first introduced and then fully explained in the textbook (for example: in the textbook for the sixth grade, this term is the axis root system).

The second group of terms are those that are introduced for the first time and generally presented to students (for example, the term cell for fifth grade students). The third group consists of those terms that were introduced earlier, but later on they are deepened (for example, the term cell for students in the tenth grade). The biological term used in a school textbook is a term consisting of a word or a minimal word combination, which is functionally adequate and has a certain place in the terminology system (Sumatokhin, 2012).

Biological facts in a school textbook perform various functions: they serve to undermine or clarify scientific theories; they are related to production practice; they express the application of theory; they enable imparting of interesting information; they have a descriptive meaning.

The school textbook, as a book, consists of a system of texts, illustrations, apparatus for acquiring knowledge (methodical apparatus) and elements for orientation in the presented contents. In the textbook of biology, different types of texts are distinguished: basic, additional, explanatory.

The basic text is the main source of educational information that learners are required to learn. The additional text aims to increase the scope of knowledge or additional emotional engagement. Additional text information is needed to better understand and acquire knowledge from textbooks. The additional text may include unique biological facts, interesting episodes from the history of biology, biographical descriptions, etc.

The explanatory text contains the information needed to better understand and acquire knowledge from this textbook. It is an important tool for organizing the independent cognitive activity of students. It is an integral part of the methodical apparatus of textbooks, which, from the aspect of the form, brings closer the textbook to the scientific and reference encyclopedic literature.

The explanatory text includes terminology dictionaries, subject terms of reference, references, list of sign labels and abbreviations.

Illustrations in a school biology textbook are an important carrier of content. They enhance the cognitive, aesthetic and emotional aspects of educational material. They visualize the educational material, activate students' thinking processes, develop their skills of direct (live) visual observation and learning.

Depending on the connection with the text, the guiding (leading), equivalent and auxiliary illustrations in the textbook are distinguished. The guiding illustrations show the contents of the educational material independently, replacing the main text. The content of the equivalent illustrations is fully or partially already shown in the text. Auxiliary illustrations complement and concretize the content of the text, contributing to the most effective perception and content assimilation.

The didactic/methodical apparatus of the textbooks has the following functions: it directs the cognitive activity of students in the process of acquiring knowledge/ assimilation of textbook content; it influences the formation of skills among students and in particular their skills for autonomous work with a textbook; it enables mastering the ways how to apply their acquired knowledge in practice. In this didactic apparatus, organization assimilation knowledge refer to the text of the paragraph, tasks performed while reading the paragraph, creative tasks, questions which are located after the paragraph.

In the didactic apparatus, creative tasks and questions can be located in front of the text, within the text and after the textual units (paragraph).

The didactic orientation apparatus contains a oriented preface, content, list of terms and system of rubrics. Oriented preface introduces students to the content and structure of textbooks; develops their ability to understand the flow of different information; forms the ability to work with textbook literature on a self-contained basis. Content is the title system of all parts of textbook with the page numbering. The index of terms allows a quick search of biological concepts in the textbook.

Headings/rubrics indicate separate parts of the learning material. The system of titles influences the organization of students' work with the textbook, structures this learning material, emphasizes the connection and subordination of its parts, helps in orientation within the textbook contents.

Verbal, graphic, and polygraphic titles are used in biology textbooks. The verbal title is the title that concisely, accurately and clearly defines the content of the marked part of the textbook. Headlines in textbooks can be in the form of photographs, drawings or diagrams, and thus indicate the main content of a particular part of the textbook. Graphic and polygraphic titles indicate parts of textbooks with numbers, letters, special characters (frames, lines, stars, etc.), special font, color, space in the text and paragraph.

In Russia, biology textbooks for the school public more than ten publishers. Textbooks that pass successfully expertise are placed on the list by the Ministry of Education. The list includes 60 biology textbooks for grades 5-9 and 19 biology textbooks for grades 10-11.

A set of biology textbooks, ensuring the continuity of the study of biology in grades 5-9 (10-11) is called the subject line. The textbooks that make up the subject line are built on a unique methodic and didactic basis and are united by the general structure of the presentation of the educational material and have a single artistic and aesthetic design.

Authors of different subject lines of textbooks differently select and structure the content of biological education. Depending on the approach to the structuring of the educational material, all subject lines of textbooks can be divided into two groups.

The first group includes the subject lines of textbooks, in which the system-structural approach is implemented, which provides a consistent description of the systematic groups of living organisms: "Plants", "Bacteria", "Mushrooms", "Lichens", and "Animals". On the basis of this approach, seven subject lines of biology textbooks for grades 5-9 were created.

The second group of subject lines of textbooks have a functional approach.This approach is based on a comparative view of the basic characteristics of living organisms (cellular structure, similar chemical composition, metabolism and energy, nutrition, respiration, excretion, growth and development, irritability, movement, reproduction) and the diversity of the living. On the basis of this approach, six subject lines of biology textbooks for grades 5-9 were created.

An important feature of the subject lines of biology textbooks for grades 5-9 is the

structure of the content of biological education implemented in them. The linear structure of programmme content assumes a consistent-linear (one by one) description of sections: Plants", "Bacteria", "Mushrooms", "Lichens", "Animals", "Man and his health", in the textbooks of biology of grades 5-9. in the textbooks for the 10-11 grades. Also, there is content of "General Biology" in the textbooks for the 10-11 grades. Four subject lines of biology textbook are related to this content.

The concentric structure of biology programme content assumes that in 5-9 grades all systematic categories of organisms are presented. Moreover, the section "General Biology" is presented in the textbooks for grade 9. There are nine subject lines of biology textbooks with a concentric structure.

Thus, in the subject lines of biology textbooks for grades 5-9, four options for realization of the biological programme content are possible:

- System-structural approach with concentric structure of programme content in the course of Biology ;
- System-structural approach with linear structure of programme content in the course of Biology;
- Functional approach with concentric structure of programme content in the course of Biology;
- Functional approach with linear structure of programme content in the course of Biology.

We will reveal some features of modern biology textbooks on the example of the subject line of biology textbooks for grades 5-9, which is called the "Life Line" (authors: V. Pasechnik, S. Sumatokhin, G. Kalinova, A. Kamensky, G. Shvetsov, Z. Haponyuk). In the subject line of the textbooks "Line of Life" for each grade, an educational and methodological set was created. It is consisted of textbook, electronic application, workbook for students and methodical handbook for the teacher (Haiboulina, 2015).

In the textbooks of this subject line, the programme content has linear structure. In the textbook for 5-6 classes, the topics are "Biology as a science", "Cell - the basis of the structure and life activity of organisms", "Variety of organisms", "Life of organisms", "Regulation of the life of organisms" and "Structure and diversity of angiosperms". Thopics are consisted of paragraphs of a fixed format. The paragraphs have a unique size (volume of two pages) in the textbooks.

In the textbook for the 7th grade, animals are described in the topics/themes: "General information about the animal kingdom", "Unicellular animals", "Multicellular animals, „Invertebrates "," Vertebrate animals "," Ecosystems ". In this textbook, the volume of paragraphs is not fixed. The information may be within a paragraph of different sizes. Along with the compulsory for the assimilation of educational material, in the content of paragraphs there are additional information that contribute to the motivation of students.

The biology textbook for 8th grade contains programme content "Man and his health" which is consisted of themes: "General overview of the human body", "Support and movement", "Internal environment of the body", "Blood circulation and lymph circulation", "Breath", "Nutrition" , "Metabolism and Energy Transformation", "Sharing of Exchange Products", "Covers of the human body", "Neurohumoral regulation of vital processes", "Organs of Sense." Analyzers", "Psychic and human behavior“, „Higher nervous activity", "Reproduction and development of man", "Man and the environment". In the textbook for the 8th grade, special attention is focused on the practical orientation of the content, in

terms of the formation of sanitary and hygienic rules related to a healthy lifestyle.

The textbook for the 9th grade contains the section "Fundamentals of general biology" and consists of the topics: "Biology in the System of Sciences", "Fundamentals of Cytology - Cell Science", "Reproduction and Individual Development (Ontogenesis) of Organisms", "Fundamentals of Genetics", " Human Genetics "," Fundamentals of Breeding and Biotechnology "," Evolutionary Teaching "," Emergence and Development of Life on Earth "," Interrelationships of Organisms and the Environment ".

In all textbooks "Life Line" for the 5-9 grades, the system-activity approach has been implemented. Each textbook begins with an orientation preface, which allows students to understand the specifics of working with the textbook and organize their educational activities. Each topic begins with a short annotated text, a picture and the headings "You will learn" and "You will learn." These headings motivate students to achieve the planned results (Petrova, 2015).

The paragraph begins with the "Remember" column, which contains 2 questions. These questions make it possible to establish a connection with the topic previously studied and motivate students to study new material. Then follows an information block consisting of text, various illustrations, diagrams, tables, diagrams. A better understanding of the content of the paragraph is facilitated by the heading "Keywords." This heading denotes biological terms.

They denote the concepts that are revealed in the paragraph. The heading "Key words" is an integral part of the activity block, which includes reproductive tasks that allow better understanding the content of the paragraph. This block also includes the "Think" rubric, which contains creative questions and the rubric "My laboratory", where descriptions of laboratory works and experiments are given.

In modern Russian education, much attention is paid to the implementation of the meta-subject approach and the formation of universal learning activities for students, which ensure their ability to independently acquire knowledge and develop skills. In the textbooks of the Lines of Life, the rubric "Steps to success" and "Lesenka" contribute to the formation of universal educational activities. They contain tips and recommendations how to create a paragraph plan, how to work with the text of a textbook, how to analyze, how to compare, how to prepare a report and successfully present it, how to search for scientific information on the Internet, and how to create a multimedia presentations (Sumatokhin, 2014).

The textbook-methodical set "Life Line" includes workbooks for students. The structure of workbooks corresponds to the structure of textbooks. The section "Working with information" in workbooks indicates tasks aimed at translating information from a text form to a tabular form. Laboratory and practical works are contained in the section "Working in the laboratory". In the section "Testing knowledge of the subject", the required test tasks are proposed. Tasks related to students' reflexion are contained in the section "Monitoring of personal results".

Expansion of the educational space in the educational and methodical package "Life Line" provides an electronic supplement to the textbooks. The structure of this electronic application corresponds to the topics/section of the textbook (Gaponok, 2013). To each paragraph media teaching objects like: drawings, interactive schemes, photos and video fragments, animations, identifiers and reference information are offered. In the electronic handbook/manual there is a section "Workshop", consisting of laboratory works. Performing these works, students will be able to observe phenomena occurring in living nature. The "Identifier" section contains an illustrated description of plants and animals.

Interactive assignments in the electronic handbook are aimed at the formation of the most important competencies in the simulator and control modes.

In the handbooks for teachers, the concept of the subject line of textbooks "Life Line", the program, methodical recommendations for lesson plans, recommendations for material and technical support of the subject, the planned results of studying the course of biology are given.

In conclusion, we note that each teacher has the right to choose from the variety of subject lines of biology textbooks those that most satisfy his needs.

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