

*History of Education: Foreign Educational Tradition  
История на образованието: чуждестранна образователна традиция*

## **THE INFLUENCE OF THE NATURAL SCIENCES COMPONENT OF EDUCATION CONTENT ON THE EDUCATIONAL PROCESS ORGANIZATION IN UKRAINIAN SCHOOLS OF GENERAL EDUCATION IN THE SECOND HALF OF THE 19<sup>TH</sup> CENTURY**

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**Abstract.** It is proved that the school education content was associated with the science development of that time by the teachers of the second half of the 19<sup>th</sup> century. The essence of scientific discussions on advantages and disadvantages of the theories of formal and material education in the studied period is characterized. The role of the first congresses of natural scientists and teachers in carrying out the issues, connected with determining the education content in general and natural sciences in particular, is revealed. It is proved that the natural sciences component of education content exercised an essential influence on the organization of the educational process in Ukrainian schools of general education in the second half of the 19<sup>th</sup> century, in particular – on the methodology of teaching the disciplines, on a choice of forms and methods of teaching.

**Keywords:** science, education, school of general education, natural science component of education process

### **Introduction**

One of the strategic tasks of education content, which was determined by the national doctrine of education development of Ukraine in the 21<sup>st</sup> century, is an optimal combination of classical legacy and modern science achievements, an employment of progressive ideas of national teaching experience. The history of the national school, the history of the education process organization of the national school is one of the central investigation problems of the modern historical and pedagogical science. On the monograph and dissertation levels, this problem was studied in the works written by V. Boiko, I. Zaichenko, S. Zolotukhina, M. Evtukh, I. Prokopenko and others. The choice of the historical period of the research (the second half of the 19<sup>th</sup> century) is caused by the dynamic development of science, especially natural sciences. Positive changes in the sphere of school education and in the development of didactics took place.

A search of new theoretical principles of the education process organization was putting into effect.

### **Literature review**

General principles, concerning the problems of didactics, are interpreted in the works by M. Yevtukh, N. Kalenychenko, B. Miturov, F. Naumenko, B. Stuparyk, O. Sukhomlynska, M. Yarmachenko. In their studies, actual historical materials, explaining various aspects of teaching theory, are interpreted. The problem of the teaching process and pedagogical legacy of the teachers of the studied period are described in the works by L. Atlantova, S. Yehorov, N. Zenchenko, A. Nikolska, Z. Hambiev. The problem of the development of didactics peculiarities in the second half of the 19<sup>th</sup> century – at the beginning of the 20<sup>th</sup> century is discovered in the work “The development of theoretical and conceptual fundamentals of home didactics (the second half of the 19<sup>th</sup> century – the beginning of the 20<sup>th</sup> century)” written by Vira Vykhreshch. The scientific works by A. Datsenko, T. Zavhorodnia, V. Zaichenko, S. Zolotukhina, I. Kurliak are characterized by well-founded historical elaboration of some general didactic problems. In spite of the availability of a great number of scientific investigations in the field of history of pedagogy, an issue of the influence of the natural sciences component of education content on the educational process organization in schools of general education in the second half of the 19<sup>th</sup> century is not interpreted well enough.

### **Methodology**

For obtaining objective information in the studied problem the following research methods were used: the chronological method – for the analysis of didactic aspects of the Ukrainian pedagogues’ creative works in the context of a historical epoch; the concrete and searching method – for seeking and analyzing published materials, historical and pedagogical publications, materials of modern investigations; the historical and cultural method – with the purpose of determining the directions of theoretical and practical activity of pedagogues; the retrospective and historical method – for the analysis of didactic and methodological works by Ukrainian pedagogues; the systematization and generalization method – for determining, comparing and correlating creative treatments written by Ukrainian pedagogues in the field of didactics; the interpretation and generalization of elaborated materials – for formulating conclusions.

### **Discussion**

With the development of civilization, the volume of knowledge, gained by humanity, the amount of information, necessary for learning, are increasing. Methods and intensity of obtaining new knowledge are dynamically changing. The development of material and spiritual culture caused widening and complicating not only a process

of accumulating new knowledge, but also a process of teaching the rising generation. A differentiation of sciences took place which caused increasing a number of subjects and their contents. In the middle of the 19<sup>th</sup> century the necessity of scientific reasons of aims, contents, principles and methods of teaching as well as organization of the system of education and scientific approach to teaching appeared.

At the end of the 18<sup>th</sup> – at the beginning of the 19<sup>th</sup> century there were two theories of the formation of education content – formal and material. The formal theory of education content (didactic formalism) regarded teaching only as a way of the development of pupils' abilities and cognitive interests, their memory, mentality and imagination. Developing value of learning material was considered the main criterion for selecting the disciplines. It was considered that the best material for realizing cognitive powers and abilities of pupils was studying languages (Latin and Greek) and mathematics. The theory of formal education was progressive for its time.

The advocates of the theory of material education (the theory of didactic materialism) asserted that the main goal of teaching is mastering the knowledge, necessary and useful for life, by pupils, but the development of cognitive powers and abilities is a result. As long ago as the 17<sup>th</sup> century, this conviction was shared by Jan Komensky, who dedicated many years of his life to working at a textbook in which he wanted to place all the amount of knowledge, necessary for pupils.

Progressiveness of the theory of material education for its time consisted in the struggle for including real life knowledge in the curriculum. The defect of both theories consists in their one-sided approach to determining education content, in contrasting formal education with material one or vice versa. K. Ushynskyi, having observed this defect, severely criticized the theories of formal material education and propounded a progressive idea of their unity. He thought that school should simultaneously solve these problems. Modern home pedagogical science considers a division of education into formal and material to be erroneous. The main task of teaching, to its mind, consists in providing pupils with knowledge, skills and habits, in training them to life and, at the same time, in developing their mental abilities and spiritual powers.

Disputes between the advocates of material and formal education played an important part in the future of natural sciences education. The advocates of material education paid attention to the fact that studying natural sciences contributes to the development of cognitive interest and abilities of pupils. In the first place, since the fundamentals of natural sciences are elementary and do not require simplifications, then in studying strictly scientific terminology, characteristic of science, every notion is associated with a certain idea. In the second place, in studying real objects the sense organs with which man gets knowledge of the outside world actively begin operating.

The advocates of material education also had another argument: the more knowledge that is used, the closer become the ideals of economic well-being, which depends on the rational employment of the natural resources of a country. The advocates of

formal education insisted on the fact that studying the humanities and, specially, ancient languages “independently enough creates and develops the spirit of man, making him ready for the perception of moral and scientific truths” (Vasilieva, 2008).

These discussions between the advocates of the theory of formal education and the theory of material education, continuing during the 19<sup>th</sup> – at the beginning of the 20<sup>th</sup> century, were of positive significance for the theory of natural sciences education content. The consequence of this was the teachers’ desire for finding out a general education value of each subject, including science, and, accordingly, for determining its place in the school course.

As far back as the 17<sup>th</sup> century Jan Komensky noted that “the change of school cause for the better” is possible on condition that some changes are put in education content. He reckoned that man should perceive the real, actual world, scientific knowledge of things, objects and their properties should be formed in him. In this connection he suggested including some elements of geography, science, drawing in school education content. He unconditionally connected the issue of school education content with scientific content, with the level of science development and, first of all, with its materialistic knowledge of things, phenomena and their properties. The progressive intellectuals of the second half of the 19<sup>th</sup> century shared these views.

The second half of the 19<sup>th</sup> century in tsarist Russia, including Ukraine as its constituent part, was characterized by the progress in science and technology, by the progress in science and technology, by considerable transformations in social, economic and political life. The progress of natural sciences, the development of materialist view of nature, the collection of natural sciences material, its systematization and classification were typical of the studied period, and it all had an influence on the development of home school and pedagogy. The changes, taking place in science, were partly connected with the publication of Charles Darwin’s book “The origin of species” (1859). The progressive part of society put an issue of bringing up children’s materialist explanation of nature, based on the direct observation of natural objects and comprehension of intercommunications between them. Natural sciences, reflecting the materialist base of life, became a means of society reorganization in tsarist Russia and a subject of discussions among the progressive intellectuals.

A lot of fundamental discoveries were made in the field of mathematics, mechanics, physics, biology, chemistry and geology. Both in tsarist Russia, and in the territory of Ukraine a series of research organizations, higher and secondary specialized schools appeared, new types of educational establishments were founded where famous scientists and teachers worked (Pavlenko et al., 2001). Just at this period the development of school natural sciences education took place. The necessity of receiving natural sciences knowledge was dictated by the requirements of time.

To the end of Nikolai I’s reign, the government, yielding to the public opinion, in 1852 restored teaching natural sciences at school after the twenty-four-year prohibition. According to the circular of the 14<sup>th</sup> of May, 1852 technical high classes and de-

partments with a larger number of technical subjects and natural history were opened in gymnasiums and district schools.

For the first time, a curriculum and a syllabus, determining natural sciences content in gymnasiums, were made. In the syllabus, given below, we can see that the consequence of the subjects of the natural sciences course changed in comparison with the one, accepted before (inanimate nature-plants-animals-man): the 1<sup>st</sup> form (2 lessons): popular and simple for child's mind talks about bodies of nature, the 2<sup>nd</sup> form (3 lessons) and the 3<sup>d</sup> form (2 lessons): zoology. The main notions of anatomy of animals, of the division of the animal kingdom into sections, classes and categories; the 4<sup>th</sup> form (2 lessons): botany (the organs of plants and their functions); the 5<sup>th</sup> form (1 lesson): botany (classification); the 6<sup>th</sup> form (1 lesson): mineralogy (a descriptive part); the 7<sup>th</sup> form (1 lesson): anatomy and physiology of man. Such a distribution of subjects shows that a matter of system was not thought over. The descriptive character of the subjects, memorizing nothing but classifications could not lead to a correct construction of the system of teaching. It should be noted that in gymnasiums not only biological disciplines, but also physics, chemistry, geography, geology and even mathematics belonged to natural sciences subjects.

Thus, due to attention was not given to the consequence of subject distribution, to their inter-subject connections and to the development of the pupils' thinking. Special attention was paid to this matter in the sixties of the 19<sup>th</sup> century at the First and Second congresses of naturalists and teachers in Kyiv (1861 – 1862). The problems, connected with the improvement of teaching natural sciences in secondary educational institutions, mainly in gymnasiums, were discussed at the congresses. Among methodological issues, the main attention was paid to the analysis of the importance of natural sciences for general education, the determination of its role in curricula of general educational establishments, the content of natural sciences education, the peculiarities of using visual teaching methods. All scientists unanimously stressed the role of natural sciences in the development of personality. Great attention was given to the methods of teaching natural sciences. The service of the congresses of naturalists was consolidation of natural sciences forces of the state and popularization of natural sciences (Ganelin, 1950).

Among their number, an issue of revising the existing syllabuses on natural sciences was raised at the First congress of naturalists and teachers. V. Devien, a teacher of the 1<sup>st</sup> Kyiv gymnasium, suggested that studying natural sciences should begin with a general course, giving primary knowledge of nature and nations of physical and chemical phenomena, necessary for perceiving the organic life. The second course, in his opinion, foresaw subject studying under the following linear consequence of disciplines: chemistry, mineralogy, botany, zoology. However, his programme was not accepted. Thus, for example, in classical gymnasiums in 1864 he proposed studying in the first and second forms anatomy and physiology of man together with zoology; in the second form, besides this, some knowledge of botany

was acquired; in the third form zoology (the theme “Insects”) and mineralogy were studied again. The arrangement of the subjects shows that anatomy and physiology of man in the first form was detached from the same subject by zoology in the second form. Besides that, one of the sections in zoology (“Insects”) was studied apart from the general course after botany in the third form. Studying inorganic nature occurred after organic one, and, hence, the explanation of the phenomena of organic nature had not any necessary basis.

An issue of logical consequence of subjects, ensuring a system of teaching, was put again by the public at the pedagogical congresses in Odesa (1864 – 1865). The congresses promoted uniting teachers of general education schools. They came to the conclusion that they should work out distinct methodological recommendations for teaching natural sciences with the purpose of forming pupils’ materialist views on the laws of nature, of developing their logical thinking. At the congress of 1864 a thought rang true that for a first form pupil that a detailed and deep study of nature is pointless, and the participants proposed a motion of teaching natural sciences, beginning with the second year of studies. It was admitted necessary to give pupils only brief knowledge of natural objects in the second and third forms. This knowledge was considered as a foundation for learning natural sciences in senior forms, where, according to the syllabus, adopted by the congress, studying chemistry, anatomy, physiology, systematic of plants and animals as well as history of plant and animal kingdoms was foreseen. The syllabus for natural sciences was composed on the basis of the conviction that systematic studying of natural sciences is possible only from the fourth form. Therefore, it expected only a general notion of nature in the courses of the second and third forms. This syllabus anticipated studying an elementary course of natural sciences in a much greater scope. It enabled a teacher to realize visual teaching methods. The demands of giving pupils knowledge of history of the organic world were new and especially progressive. But there were no courses of anatomy and physiology of man and geology in the syllabus, and it should be considered as a refusal of the achievements, consolidated by practice of teaching in the previous years.

The Second pedagogical congress of 1865 paid special attention to determining a content of education in general and of natural sciences in particular. In the process of making a syllabus, the congress relied on the directions of the Minister of National Education, according to which in the first three forms zoology, botany and mineralogy should be taught in the form of tales. The participants came to the conclusion that the purpose of teaching natural sciences in the first primary forms should involve the development of pupils, but not only informing them about scientific facts. Teaching natural sciences must be realized in the way to form children’s interest and desire of acquiring some new knowledge on the basis of visual teaching methods.

The syllabus, adopted by this congress, had some essential differences. There was no introductory course for acquainting junior schoolchildren with nature. Studying anatomy and physiology of man was expected, but it lost its independent significance

and was a part of zoology as an elementary section. The reduction of systematics of plants and animals was planned. Some lowest plants were included in the course of botany. The course of inorganic nature was the most capacious, and it was studied in the third, fourth and sixth forms. Geology, besides mineralogy, was in its content.

The changes in the content of natural sciences education found their realization and development in corresponding textbooks and manuals. In the second half of the 19<sup>th</sup> century textbooks and manuals for natural sciences disciplines were written, and they met the requirements of the syllabuses of the Ministry of National Education. It should be noted that textbooks are exponents of education content and, at the same time, a model of a certain methodological system. The analysis of a textbook enables to come to a conclusion of dominating methodological orientations and methodics principles of teaching a subject at the moment of its writing.

In the studied period, teaching natural sciences in schools of various types was of formalistic scholastic character. The textbooks for natural sciences subjects were of the same sort, and, according to the words of V. Shimkevich, a Russian zoologist and scientist, they lagged behind science and were an “instrument of training memory and depressing spirit”. The similar appreciation was given by many other home scientists. The main deficiency of the available textbooks consisted in the fact that all their content came to the only goal – to the religious explanation of nature. The similar character of the learning material, deepened by sharp lagging behind the development of science, by maximum scholasticness of interpretation, by lack of necessary pedagogical editing eliminated scientific character of the textbooks and, at the same time, their educational value. The leading pedagogues and specialists in educational methods sharply spoke against the religious purposefulness of textbooks, defended the necessity of forming the rising generation’s scientific world outlook which was impossible without a radical thorough revision of textbooks. In the first place, it concerned the textbooks of natural sciences series.

New official textbooks by Yu. Simashko (1852), I. Shykhovskiy (1853), E. Hofman (1853), A. Horyzontov (1859), P. Stepanov (1860) were published. In educational books much more room was allowed for systematic of organisms. Special methodological instructions were not published, but in the introduction to new textbooks there were some guides on methods of teaching which were in no way conspicuous for novelty. The content of textbooks of that period was difficult for perception. More often the state of natural sciences at school became a subject of sharp criticism. A question of the necessity of natural sciences of school was put (Raikov, 1960).

The importance of creating a high-quality textbook both as the main medium of teaching and as one of determining factors of full-blooded functioning educational institutions was clearly realized by scientists, pedagogues and specialists in educational methods. On the basis of critical review of the available books for teaching by German authors (A. Luben) and home authors (K. Ushynskiy, Paulson, Basystov), at congresses of teachers, at meeting of different pedagogical societies a problem of working out a

unity of demands, made a school textbook, was discussed: the idea of a unity of formal and material education should form the basis of a textbook. A textbook must combine in itself the formal aim – studying a native language and general development of pupils – and the material aim – giving elementary, intelligible for child's age, information from surrounding nature and life; the content of a book must stimulate studying, involve pupils in original work (questions, exercises, sums, tasks), in research quest; the content of a book must be of real character which would contribute to forming a real view on the surrounding world and life; the content of a book must develop children's power of observation, intellectual curiosity, form love of work and of mutual assistance; during the selection of material attention must be paid to the development of children's love of nature, a native language, a national mode of life; the content of a book must be comprehensible, fascinating, contain interesting facts of surrounding life and nature; a book must be written in a plain, clear, intelligible and literary language; the content and form of a book must correspond to age peculiarities of children.

The scientific approach to the content of school education allowed teachers to formulate the main principles of organizing the educational process; among them – the necessity of seeing in a child a personality, sympathetic, attentive and trustful treating him or her; the desire of teaching staffs to create conditions for the harmonic development of pupils, for the realization of all their abilities, to inculcate independence, activity and resourcefulness, a liking for brain work and physical work; the creation of conditions for the development of cognitive activity and accumulation of vitally necessary knowledge; ensuring a tight connection of teaching with surrounding life, with the support on pupil's life experience; the creation of the psychological comfort atmosphere; the creation of trustful relations among all the participants of the teaching process.

The progressive teachers and specialists in educational methods understood that a new content of education could not be studied with the aid of old (scholastic) methods of teaching, adjusted to idealist content. Therefore, the matter of changing methods and means of teaching was of current interest. Since they unreservedly connected the issue of school education content with scientific content, with the level of science development of that time and, first of all, with its materialist knowledge of things, phenomena and their properties, the scientists found solving the problem of teaching forms, of methods and means in science of that time itself.

It should be noted that didactics of the 17<sup>th</sup> – 18<sup>th</sup> centuries in its principal methods and means developed under the influence of induction prevailing in natural sciences. The progressive pedagogues were supporters of this cognition method, being of importance in the struggle with idealist content of scholastic education. First, this method enabled to connect teaching with scientific, materialist content of education which was very important in the struggle with idealist content of scholastic education. Secondly, it made children familiar with sensitive and subject activity.

Studying the Circulars, which determined the teaching activity order in educational establishments of the second half of the 19<sup>th</sup> century, made it possible to distin-



guish the following methods of teaching: (i) *verbal methods* – explanation, generalization, formulation of nature laws, conversation (heuristic conversation), method of problem questions, mechanical method (simple memorizing the material without its explanation); (ii) *visual methods* – illustration, demonstration, inductive (studying the material from the simple to the complicated), deductive (studying the material from the general to the particular); (iii) *practical methods* – method of exercises, original work with a textbook, formulation of hypothesis on the basis of observation, practical exercises in caring of plants and animals, elements and herbariums.

For the sixties of the 19<sup>th</sup> century it was typical of giving more preference to the natural history approach to interpreting information in the process of teaching natural sciences disciplines. The famous specialists in educational methods and naturalists used the following forms and methods of teaching: excursions to nature; experiments; practical activities at school and at home; making and studying collections; independent observations of living objects; conversations (explanatory and heuristic). Using these methods in the process of teaching promoted training children to do some logical operations, to form scientific world view, to develop abilities, interests and nature motivation to learning.

For the second half of the 19<sup>th</sup> century it was characteristic of forming and theoretical substantiating the method which was called the research method (Sniegiriova, 2010). The leading pedagogues and specialists in teaching methods made attempts to build educational activity at school on its base. Among the most widespread names of the research method in teaching in the second half of the 19<sup>th</sup> century was “heuristic”, “inductive”, “visual and heuristic” and others. The content, determining these names, was, in fact, the same. It was a matter of independent search activity of pupils who, under the supervision of their teacher, discovered, basing themselves on concrete facts, truths unknown to them before, logically passing the way of a researcher. The main feature of this method, that distinguished it from the method of heuristic conversation, was the perception by a pupil of a real phenomenon, the observation of concrete facts. Being born in the methods of teaching natural sciences, the research method in due course began to be used in teaching other subjects.

As the scientific content penetrated the school education, the inductive method became dominating in it, having found its expression in the principle of visibility, the main principle of teaching during the 17<sup>th</sup> -19<sup>th</sup> centuries. The significance of demonstration was seen by pedagogues in the fact that it contributed to the development of child’s apprehension, it taught a child to see correctly an object and study it deliberately, to express his thoughts, to master speech skills; it developed memory, ability to compare, to generalize, to observe; it increased a stock of child’s real knowledge; it gave children clear, distinctive notions and that simple, elementary information which was the basis of child’s mental development and further acquirement of knowledge; it eliminated erroneous knowledge, blind imitation and repetition of other people’s words and notions (Fedorova, 1958).

## **Conclusions**

The present study showed that the development of natural sciences knowledge entailed changes in curricula and syllabuses of general education schools. A number of taught natural sciences disciplines increased. The specific character of teaching natural sciences disciplines involved changes in organizing all the educational process in general education schools. Principles, forms and methods of teaching both natural sciences and other disciplines were improved. Essential changes took place in the methods of teaching disciplines.

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