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The Use of Integration Method in Shaping Students' Scientific Worldview by Means of Biology and Geography as School Disciplines

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Abstract: The study discusses the content of school subjects of geography and biology, revealing the nature and dynamics of natural, ecological processes, understanding the essence of the interaction between nature and society is characterized by the integration of knowledge, ideological education as priority, allowing to view the outside world from the perspective of science and determine their relevance to the ongoing reality to form own judgment and make the right decisions in order to achieve harmony between nature and society.

Key words: The scientific worldview, research method, biological method, environmental awareness, environmental education, interdisciplinary communication, Federal state educational standard, universal learning activities, educational-methodical complex

INTRODUCTION

In accordance with the Federal Law of 1 December, 2007 No 309 (On making amendments to some legislative acts of the Russian Federation with regard to changing the notion and structure of the State Educational Standard) the compulsory introduction of the Federal State Educational Standard in all educational institutions commenced in the 2011-2012 academic year.

The second generation standards are focused on developing a modern and moral person who is able to make decisions (foreseeing their possible consequences), feels responsible for the future of his country and its social-economic prosperity and is ready for cooperation.

The main competencies of a modern student such as studying skills, making decisions, joint work, research, project, communicative skills, etc. demand systematic approach in education and bringing up students of general education schools (Panfilova, 2009; Schlechty, 1990; Gluckel, 1990; Newmann, 1996).

In the modern educational system, interdisciplinary barriers are distinct both in Russia and abroad. It decreases the cognitive motivation of students because they cannot understand the links between objects and natural phenomena and their role in their lives which is also a serious obstacle for shaping the scientific worldview based on the concept of integrity, multi-level organization of wildlife and evolution.

Worldview is a system of generalized views on a person's world and their status in it, methods of using these views for cognizing the reality, orientation in the world and evaluation of human activity in nature and society.

According to Vileev (2001)'s figures, 43% of the young people polled consider themselves not moulded as personalities and do not feel confident in the modern world.

The science education plays the decisive role in shaping the scientific worldview. The integration of scientific disciplines is also very important for shaping basic national values in accordance with Federal State Educational Standard.

Personality development of students is the main idea of the new standard. It is also connected with shaping the scientific worldview in general education school students.

MATERIALS AND METHODS

In this study, the following theoretical and empirical methods were used: the study and analysis of methodical, biological, geographical and psycho-pedagogical literature; the study of normative and methodological documentation and pedagogical experience; monitoring the educational process; testing and surveying.

Main part: In shaping the scientific worldview, it is necessary to respect the principles of continuity which are based on the traditions of bringing up and teaching in pre-school institutions.

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The newly created programmes, developed in accordance with the renovation requirements of the Russian pre-school education, provide favourable conditions for shaping basic national values.

From the age of 3-4 years, children are engaged to care for plants and animals in the kindergarten's wildlife corner. They can take part in gathering vegetables and seeds, transplanting flowering plants and growing medicinal herbs and green forage for birds and animals.

The complex dealing with the scientific worldview shaping problem is carried out through children's varied activity. For example, children are suggested the following topics for discussion: "How do we help animals" "What would happen if there were no forests"; they play different roles in the games "Bacteria: our friends and enemies", "Nature and humans". Children go on excursions to forests, meadows and bodies of water where they discover the conditions of ecosystem integrity preservation. Logical problems can be suggested to preschool children already: "Why has mom forbidden burning dry leaves in the garden?"

Ushinsky in his works "The Native Speech" and "The Children's World" lays special emphasis on the significance of the nature's logic for the development of mentality, memory and imagination in children since they are as much as 3 years old (Ushinsky, 1949).

An interesting experience of environmental knowledge formation and further, the development of the scientific worldview on its basis by means of various children activities in the Municipal Preschool Educational Institution No. 11 "Antoshka" in Zelenodolsk, Republic of Tatarstan, demands studies and amplification. For more than 10 years the staff of the kindergarten, along with the professors of the Botany and Plant Physiology Department of Fundamental Medicine and Biology Institute of the Kazan (Volga region) Federal University and the students of the pedagogical class of A.S. Pushkin Lyceum No. 9 and students the future teachers have been implementing a problematic educational programme called "Nature is our home". This programme is founded on the basis of research and evaluation experiment of children where a child appears as the main researcher.

A complex of "creative assignments" has been worked out for each experimental cycle. A child in the process of completing these assignments relies on the experience he/she has gained in the experiment. For example, children carry out tests on the life conditions necessary to plants and animals.

University teachers and students of the pedagogics department have prepared a questionnaire for parents and children in order to ascertain the degree of the environmental consciousness formation.

For pre-school children, there are exercises of different level of intricacy which unravel their ability to make logical operations, explain the weather phenomena from the position of making cause-effect connections. The results of the experiment witness its success. The >80% of children explain the weather phenomena according to the scientific worldview.

The new generation Federal State Educational Standards in the Russian Federation pay a significant attention to the monitoring of interdisciplinary universal learning activities of students which are the basis for continuing the shaping of the scientific worldview (OECD, 2005, 2009, 2010, 2011), especially such cognitive universal learning activities as the logical actions of comparison, analysis, synthesis, generalization, classification on the genus-species indications, determining analogies and cause-effect relations, building the discourse, attribution to well-known terms. By the end of the 4th grade, students must possess the universal learning activities on the level of using the activity in the context of the educational objective.

Now-a-days school graduates as well as people overall, still have a consumer's approach to nature. Environmental problems are not considered important for an individual, the need for nature preserving activities is not well developed, lessons on ecology should be continued in the primary school.

The subject matter of the environmental education in the primary school includes lessons on the Russian language, nature study and handicraft lessons. Nature study provides junior students with the scientific basis of the necessity of environmental protection. The main ideas and the definition of the nature study:

- Nature is the environment, the necessary condition of human's life (human obtains air, water and raw materials from the nature)
- The human labour is the condition of using and saving the natural resources of the motherland (the observation of conduct rules in the natural environment, study and assessment of the state of the natural environment green patrols, planting of greenery in the school)
- Understanding of the natural integrity (discovering the food connections in wildlife, adaptation of organisms to their natural habitat and seasonal weather changes, the human impact on the life of plants and animals)
- The term: Nature (the first topic of the Nature study course is "What is nature?"); the definition given is "Nature is the human environment inhabited by plants and animals". The main indication of the animate and inanimate nature is described in the course as well as the integrity of nature

- Understanding of a human being as a biosocial being connected with its habitat
- The term: protection of nature is an activity aimed at saving and multiplication of the natural resources, e.g., in the topic "The spring's natural phenomena" (protection of young animals)

Shaping the scientific worldview is one of the most important objectives of the contemporary school and certainly the worldview defines behaviour and activity of an individual in society

The subject matter of school courses in Geography and Biology has a very affluent worldview potential characterized by dialectic unity and universal interaction of natural objects and phenomena.

The subject matter of the natural science disciplines in the basic school gives an opportunity to discover the worldview ideas for the scientific understanding of the processes which progress in the earth's biosphere and its geographical environment.

In the process of studying biology and geography, students learn the indications of objects and phenomena, structure, functions, development, dynamics of the interaction where the dialectical logic, expressed in the worldview ideas, appears. For school subjects they are defined by Gerd, Zverev, Verzilin, Corsunskaya, Gerasimova, Kovalevskaya, Pancheshnikova. The study of biology and geography gives some ideas about nature and its objectively real form.

The idea of the materiality is expressed in the contents of physical geography by the integrity of the spatial-temporal changes all the objects, phenomena, processes of the geographical environment are material and interrelated. The understanding of materiality in the course of Biology is connected with the study of the diversity of flora and fauna which are dependable on the living conditions with the study of the cell as a structurally functional unit of life forms of metabolism, heredity and mutation. In materiality, the idea of integrity and interrelatedness of the world is embodied (Beketova, 2012).

All the components of the geographical envelope do not exist in isolation from each other but form a single integrated system such as natural complexes of the earth (geographic belts, natural areas).

The integrity of an organism's life in biology can be considered by means of an example of plant and animal organisms which represent a unified system of interconnected systems of organs and their functions.

The concept of the integrity is kept in a constant motion and change, interaction and interdependence of natural components in animate and inanimate worlds, manifested in the cycles of matter and energy: the water and air cycle, the biological cycle and others. All cycles are not completely closed and the gap between these cycles forms a vector of directional change, i.e., a vector of development (Lyamin, 1989).

The development is achieved by a struggle of opposing phenomena such as variability and heredity of characteristics in the animate world, exogenous and endogenous factors of the topography in the inanimate world.

Introducing students to the history of the formation of geographical envelope allows to reveal a development process of nature. In the process of studying wildlife in the Biology course students acquire knowledge of the evolution of the organic world and reveal the causes and patterns of historical development of organisms (Beketova, 2012).

Thus, the biosphere and the geographical envelope of the Earth are self-developing systems that are in a constant motion and change in space and time under the influence of endogenous and exogenous processes.

The formation of ecological consciousness is inseparable from the scientific view of the world and nowadays it applies to the basic national values.

The subject matter of biology and geography aims to study issues as:

- Learning the character, essence and dynamics of natural, ecological processes
- Understanding the main features of interaction between nature and society, importance of environmental protection and rational nature management, recognition the high value of life in all of its aspects, formation of ecological consciousness
- Identifying the patterns of population distribution, the territorial organization of the economy due to the natural, socio-economic, environmental factors, revealing the dependence of human adaptation and health to the geographical conditions of life

Biology and Geography courses introduce a system of the following concepts: the environment and its ecological factors, ecology of organisms, population ecology, ecology of ecosystems, social ecology.

Among the environmental concepts used in the study of natural sciences, the concepts of habitat, environment, anthropogenic factors, biosphere, global and regional environmental problems, protection of environment and rational nature management can be distinguished.

The link between Biology and Geography subject matters is the study of the organisms' expansion

according to the zonal distribution in the environment, living organisms' activity under the influence of endogenous, exogenous factors of environment and human impact.

On the basis of ecological concepts, the worldview is shaped which represents the general knowledge explaining the basic laws of nature.

The idea of the complex scientific approach to the nature management is reflected in interdisciplinary solution of overriding environmental issues. The objectives of scientific disciplines in this field are reduced to "the development of scientific bases and transformation of nature, the elaboration of recommendations for the prevention of the negative effects of human activities, the environmental monitoring" (Rakovskaya, 2005).

The idea of cognoscibility of the nature development laws is reflected in the subject matter of the disciplines under consideration. In the process of learning, students explore research methods of environmental problems: environmental monitoring, biotesting, bioindication, geographic forecast, environmental impact assessment which prepare the basis for the conclusion on the cognoscibility of the earth's nature development laws.

The specific objectives of Biology and Geography as parts of the basic school curriculum are as follows: shaping the system of geographical and biological knowledge as part of biological and geographical worldview which is ultimately regarded as an element of a common scientific worldview; introduction to the educational culture; recognition of the value of life in all of its aspects; environmental consciousness; mastering the research methods; shaping intellectual skills based on the students' cognitive motives (Beketova, 2012).

According to "Sfery" ("Spheres"), an innovative educational project launched in 2003 by the Russian Academy of Sciences, working programmes on Biology and Geography for the "Sfery" teaching packages have been created by the Russian Academy of Education and "Prosveshcheniye" publishers, taking into account the conceptions of moral development and character education. Most of the focus is on shaping the universal learning activities: cognitive, personal, regulative and communicative ones.

The set goals lay emphasis on the development of logical, dialectical thinking as the basis of scientific worldview by helping students to master the universal learning activities based on school courses in biology and geography.

Teaching packages for every school subject have been created. The "Sfery" teaching packages for Biology and Geography consist of textbooks, electronic applications, workbooks, practice books, tests, guidelines for teachers, atlases and outline maps.

In 2006, the first textbook in the "Sfery" series came out: "Geography. The Earth Planet" (5-6 grades) by Lozhbanidze; in 2007 another textbook, "Biology. The living organism. For 6th grade" by Sukhorukova, Kuchmenko, Kolesnikova.

In the 2013-2014 academic year, Republic of Tatarstan joined the "Sfery" textbooks approbation experiment, on the basis of municipal budgetary general education institution "Kazan Lyceum No. 5" and municipal budgetary general education institution "Pushkin's Zelenodolsk Lyceum No. 9". "Prosveshcheniye" publishers' public company and the Volga trans-regional centre of professional advancement and adjustment training for educators of the Kazan (Volga region) Federal University oversee the implementation of "Biology. The living organism", the "Sfery" teaching package for 5-6 grades. The preliminary work on the implementation of "Geography.The Earth Planet" teaching package for 5-6 grades is also starting.

The analysis of the "Sfery. Biology" teaching package programme, compiled by Sukhorukova and Kuchmenko for general education schools, allows us to speak of the existence of profuse materials for creating interdisciplinary links between biology, geography, ecology which introduce the natural dialectic interrelations into the subject matter of classroom disciplines, shape the systems of knowledge, skills, competency, develop cognitive activity, increase the scientific character of education.

For example, the programme provides educational excursions such as "Autumn presence in the life of plants of the native land", "Plant complex of forests in the native land", "Park as an artificial ecosystem", "Forest mammals of the native land". Equally informative material for the establishing of interdisciplinary correlations can be found in the "Geography. Planet the Earth. For 5-6 grades", developed by Dronov and Savelieva. For example, here are several topics of the section "Biosphere: the shell of the Earth":

- Human impact on the biosphere. Protection of flora and fauna. Flora and fauna observation as a way to determine the quality of the environment
- Earth's biosphere. The diversity of flora and fauna of the earth
- Peculiarities of living organisms on the land and in the World Ocean
- The biological cycle. The role of the biosphere

The whole matter of the components of "Sfery" teaching materials in biology and geography is aimed at giving the foundations of environmental consciousness, worldview ideas and concepts. It is designed on the basis of system-practicing approach incorporating the

successive formation of such logical universal learning activities as establishing cause and effect relationships in the environment. For this purpose the "Look and Think" section is used, tasks requiring mental operations are presented in the practice book.

The working programmes for the "Sfery" teaching packages also contain requirements for learning results (especially concerning personal improvement) including students' mastering the system of modern world attitudes, value orientations, ethical behaviour, basic knowledge of healthy lifestyle and health saving technologies, maturity of cognitive interests and motives.

The requirements for the interdisciplinary results of the education include acquisition of universal learning activities that account for the abilities to study, plan, estimate to organize cooperation to define aims and objectives of studying to develop motives for activities, master research and project technologies.

The subject results include shaping the geographical and biological knowledge as components of the scientific worldview and scientific way of thinking; practical skills of working with geographical maps and devices; ability to set up an experiment and explain its results; knowledge of the principal rules of conduct in the wild; analysis, estimation and forecast of the anthropogenic influence on the environment; the influence of hazards on human health.

The programmes of shaping universal learning activities which constitute the basis for self-development and lifelong learning are aimed above all at shaping the students' worldview and system of values.

Shaping the scientific worldview of higher education students, the to-be science teachers in particular, may be carried out through scientific research work (Ellis *et al*., 1991; Hawley and Valli, 1999; Ornstein and Hunkins, 1998).

The substance of the students' research work is as follows: doing creative laboratory work, term and graduation projects; guiding the students' research activities during the teaching practicum (Khutorskoy, 2008).

RESULTS AND DISCUSSION

The Kazan (Volga region) State University has long-standing traditions of students' research work: working in scientific circles and task groups, participation in Russian and international scientific events, publication of articles in cooperation with their teachers.

The results of surveys among students, conducted since 1995, witness that most of them (78.5%) have no difficulties shaping scientific worldview and environmental thinking in general education school students.

For several years, a solid piece of work on the study of the problem of shaping the scientific worldview has been implemented at the professional advancement and adjustment training for Biology, Chemistry and Geography teachers.

In the course of research, teachers were questioned on the issues of necessity of shaping scientific worldview in general education school students. Questionnaires of 200 teachers' from the Republic of Tatarstan were collected and analyzed. One of the questions was: "Do you think that shaping the scientific worldview and environmental thinking in general education school students is necessary in the modern conditions?" 76.2% of the asked teachers answered in the affirmative. However, 20.6% do not consider shaping scientific worldview and environmental thinking in general education school students during the lessons necessary. They motivate their answer by the lack of study time and supremacy of school students' biological, geographical knowledge formation. At the same time, 3.2% of the asked teachers did not answer this question (Fig. 1).

The given percentage of the answers gives the evidence that Biology and Geography teachers recognize the importance of shaping the scientific worldview in school students. Nevertheless, the analysis of teachers' answers to the question: "Do you shape scientific worldview and environmental thinking with general education school students systematically?" shows that while 76.2% of teachers emphasize the need of shaping

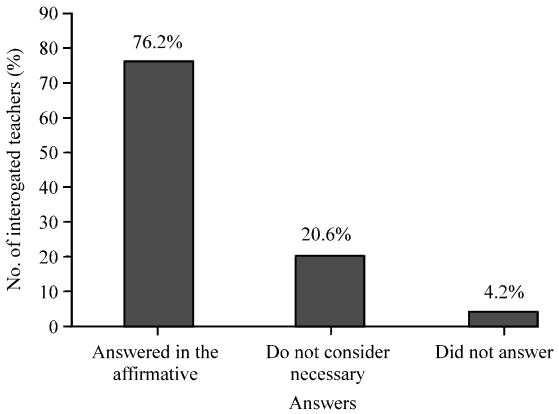

Fig. 1: The results of the analysis of teachers' answers to the question: "Do you think that shaping scientific worldview and environmental thinking with general education school students is necessary in the modern conditions?"

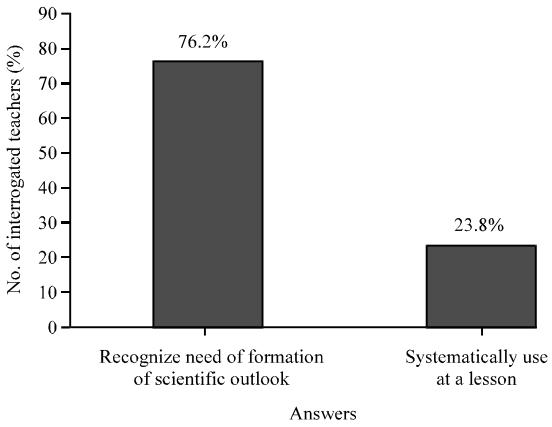

Fig. 2: The results of analysis of teachers' answers to the question: "Do you shape scientific worldview and environmental thinking with general education school students systematically?"

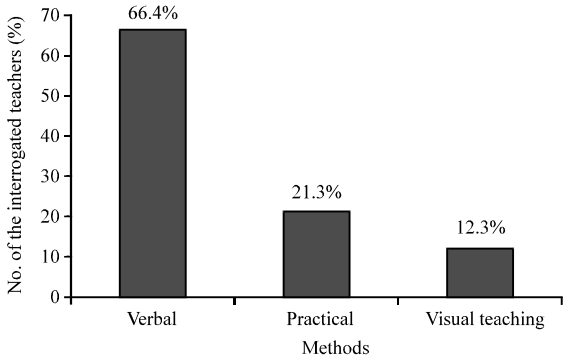

Fig. 3: Methods used by teachers in shaping the scientific worldview and environmental thinking in general education school students

scientific worldview with school students at the Biology and Geography lessons, only 23.8% of teachers work systematically from lesson to lesson (Fig. 2). We suppose that such distribution of answers indicates the lack of understanding the importance of shaping the scientific worldview in educational process.

To analyze the nature of the teacher's activity on the formation of the scientific worldview with older students in the questionnaire, questions were formulated with the aim of identifying methods that teachers use in their research. The answers were distributed as following: when asked about the methods and instructional techniques used in shaping the scientific worldview with older students, the teachers of Biology and Geography in most cases, 66.4% say verbal methods, among which are the following: lecture 22.2%, conversation 19.3% story 15.6%, students' reports 9.3%. Practical methods in the responses of teachers occupy 21.3%, visual 12.3%, respectively. At the same time, Biology and Geography teachers define observation and experiment among practical methods and among the visual ones demonstration of experiments, natural and visual objects (Fig. 3).

However, the majority of teachers (85%) notice difficulties in practical realization of interdisciplinary approach to education and shaping the scientific worldview based on it. Thus, we took this problem into account when delivering lectures and giving classes at the professional advancement and adjustment training for Biology and Geography teachers.

Further improvement of the research competence of Biology and Geography teachers, their ability of developing the scientific outlook on the basis of interdisciplinary approach occurs during the refresher and retraining courses held at the Volga trans-regional centre of professional advancement and adjustment training of educational system employees.

As a conclusion, it can be noted that at school the subject matter content of biology and geography courses which reveal the nature and dynamics of natural processes and ensure understanding of the essence of human-environment interactions is characterized by the knowledge integration and the priority of students' ideological education. The last one allows approaching the world from the perspective of science and determining the attitude to the ongoing reality as well as allows students to form their own judgments and make the right decisions for achieving the harmony between society and nature.

CONCLUSION

The scientific worldview is the most common and is the highest state of social consciousness. Its main criteria are: the profundity and systematic character of scientific knowledge, the social activity of an individual in the modern world and the ability of using dialectical approach for comprehending the reality.

The results reveal and substantiate the forms and means of developing the scientific outlook based on the integration of Biology and Geography at the different levels of the Russian educational system: pre-school education, primary general education, basic general education and secondary (complete) general education.

The correlation between the environmental consciousness as one of the most important national values in Russia on the one hand and the scientific

outlook on the other hand is significant for the spiritual and moral development of children and young people.

It is necessary to increase the requirements regarding the level of scientific outlook for students who are going to become secondary school teachers under conditions of the Russian education system modernization.

The integrative education in biology and geography is a necessary scientific and educational direction which allows complicating the interaction between the subject and the object of the learning process under the conditions of the acceleration of scientific-technical progress and socio-economic development. These factors deepen the contradiction between the growth of diverse scientific information volume and human capabilities of acquiring necessary knowledge, developing indispensable skills and abilities during the training which helps a person to meet the requirements of modern society.

The accelerating socio-economic development of any country is primarily connected with the improvement of the public education system which in its turn, implies increasing of the learning efficiency, radically improving the young people's preparation to the independent working life and to bringing up conscious citizens of modern society.

The process of bringing up an educated person, a citizen, a patriot, first of all, implies forming the scientific outlook of the younger generation which is based on the harmonious system of philosophical views.

The following factors promote the formation of the outlook:

- The subject matter content of school courses (those related to the evolution of nature and those connected with the objective laws of society)
- The methods used by teachers in their work (involving the students in research work; giving them the tasks to analyze, compare and synthesize the material)

Revealing the objective laws of nature and society development, it is essential to be concerned with how to apply the knowledge to practice and how to help students choose a career path in accordance with the individual vocation and society's needs.

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