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The backbone of research in modern education in the context of the competence approach

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Abstract. Modern society, which sets problems of translating culture in a new way, determines new criteria for the educational paradigm. Globalization tendencies in modern educational environment induce the problem of necessity to integrate educational and scientific resources into Russian education. The aim of this article is to demonstrate a significant part of scientific research as a consistent factor in formation of the competence-based model of a professional. It is shown that students' research work beyond the process of education becomes a unique sort of teaching activity, which has a number of essential differences from the main traditional teaching techniques for compulsory courses. The results of students' research work in the ecological situation of Siberian region are presented. The competencies acquired by students during this work are revealed. It is noticed that integrating the theme of students' research work with compulsory courses is one of the most important teaching peculiarities in formation of personal attributes of a future highly-qualified professional, which form the basis of professional mobility and competitiveness. It is summarized that an interdisciplinary character of research work in the modern educational paradigm is aimed at solving innovative tasks of integrating educational, scientific and practice-oriented constituents in the context of the competency building approach.

Introduction

Innovation processes related to globalization of society in information and culture-communicative spheres affected such important component of cultural environment as a system of education. In modern Russian higher education, we can witness transformation of competency ideas that form a graduate; this is mostly caused by realization of the Federal State Educational Standard (FSES) of the third generation, focused on the competency-based approach. The competency-based approach today is in the trend of studying the applied aspect of education in the context of economics and society demands, which specify educational tasks where the cognitive-thematic content of education is supplemented by the over-thematic content [1, 2].

Materials and methods

Globalization tendencies in modern education result in the necessity of interdisciplinary integration of educational and scientific resources in Russian education. Thus, under current conditions connected to modern ecological, socio-ethical, socio-biological problems there has been developed a new type of modern interpretation of science, which integrates cognitive methodology of Natural and Humanitarian sciences [3].

The authors focus on the fact that it is students' scientific research (SSR) going beyond the process of education that becomes a specific system factor in formation of a competency-based model of a specialist. Realization of the competency-based approach to formation of a future graduate facilitates the main objective of higher education – training a qualified specialist of an adequate profile, competitive in the job market, having a perfect command in his/her profession and a good command in neighboring spheres, capable of effective work in his/her speciality, ready for further education, social and professional mobility.

To justify the mentioned bullet points, the authors turned to the following conceptual approaches: modern theories of culture and education, a person-centered education paradigm, the competency-based approach. The letter, in the context of Russia's integration in the Bologna process, appears to be the most effective system methodological framework.

In addition, there were used methods of logical analysis, a descriptive method, which enabled to describe the phenomena under investigation through the

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notions expressing their main semantic content. Empirical methods of chemical and physico-chemical qualitative and quantitative determination were employed in this paper.

Results and discussion

Today, in spite of the complex diversity of interpretations, the competency-based model proceeds to realization, which holds the result of education in formation of an integral personality, ready to act in a situation of uncertainty, but not just within the acquired knowledge, thus presenting the concept of "educational knowledge" by M.Sheller [4]. The works of V.A.Bolotov, V.V.Serikov, J.G.Tatur, A.A.Verbitsky, I.A.Zimnyaja, V.I.Baidenko, P.Bimmel, G.Neuner, K.Kleppin, S.Neuner, U.Rampillon and many others are also devoted to speculations over the meaning of the competency-based approach. It is difficult not to agree with V.A.Bolotov and V.V.Serikov who claimed that there exist two types of education. The first, presented by curriculum, must be studied and tested, and the second – "hidden education" [5]. Under "hidden education" he means the results that form accomplishments (in contrast to just training), i.e. the unity of training, upbringing and personality development, and hence competency – all that cannot be acquired only from knowledge and skills. Here it is appropriate to remember that formation of competences suggests the unity of educational and character building activities where the culture of rational thinking and spirituality is blended. The definition of professional competence is used to denote wholeness of training characteristics and includes such components as individual, social, informational, special, communicative, and ecological.

Obviously, in professional education scientific activity becomes an important constituent of the educational process, an essential means to increase motivation to study, and to heighten interest in speciality and job. Nowadays, the question how to attract young people into science and how to consolidate young specialists in science is widely discussed; a lot of concepts and different governmental measures to solve this problem are offered and developed. Training the future scientific elite is only possible if students are involved into research and scientific work as early as possible. It is important both for training future scientists and for emphasizing the idea of quality of education.

One of the main methodological approaches to organization of research work is the ability of the lecturer to turn students' research activity into an effective tool for developing their creative abilities and skills, increasing their motivation to learn subject matters [6].

The implementation of the research program suggests solving the following problems:

- creating material and technical resources for future activities;
- providing a qualified research staff who can perform expert management of students' creative teams;
- involving students to do scientific and research work.

To increase students' awareness and interest to research issues, it is extremely effective to organize lectures and students' meetings with outstanding scientists, school professors and a leading staff of research laboratories. Here we can also mention organizing and holding excursions to university departments and science labs, and demonstrating unique research equipment to acquaint students with advanced achievements of modern science. Such events encourage students' interest in modern scientific problems.

It should be noted, that the personal example of a lecturer in scientific and creative research is a determining factor of students' participation in such work. Under lecture's leadership, students can perform project, research or creative work with deep analysis of primary sources of information and search for solutions to realize their own ideas. The logic of building such activities is greatly similar to a research one. All of them have similar structure and steps of implementation, they are characterized by a principle of cooperation between a student and a lecturer, and they all must be based on research according to the topic, goals and tasks.

Integration of students' research work with general subjects is one of the most important learning features in the process of building future highly qualified specialist's personality. Through immediate application of knowledge obtained during the lessons on different disciplines, solving their own creative tasks, students achieve practical consolidation of knowledge. In research labs of Tomsk Polytechnic University (TPU), students of TPU and Tomsk Technology and Humanities College for more than 10 years have been performing their research work [7].

Within the framework of this research, students carry out the works dealing with ecological problems of Siberian region:

- detecting heavy metals in biological objects for the medical university hospital;
- developing techniques for testing a food quality;
- conducting chemical analysis of Siberian resorts' waters;
- conducting protein-determination in feeding stuffs;
- analysis of snow cover in Tomsk city;
- use of sorbents in water purification facilities;
- conducting chemical analysis of drinking waters in Tomsk area;
- conducting chemical analysis of spring waters in Tomsk city.

As an illustration, let us focus on the following research works.

During the work **"**Detecting heavy metals in biological objects", there was a research on detecting heavy metals in hair using stripping voltammetry; the results give the picture of the ecological situation in which 15 test patients were held for a prolonged period of time (figures 1-3).

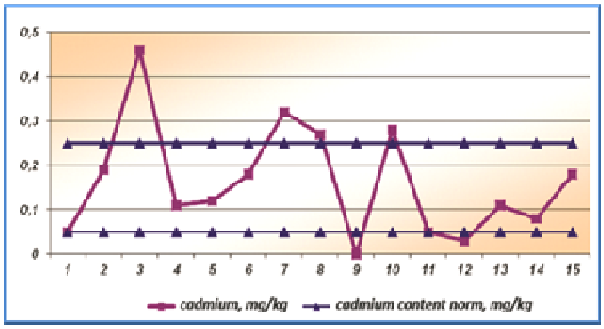

Fig. 1. The diagram of Cadmium content in the hair of 15 test patients

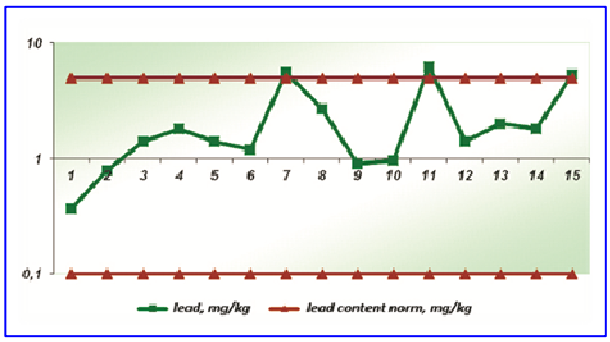

Fig. 2. The diagram of lead content in the hair of 15 test patients

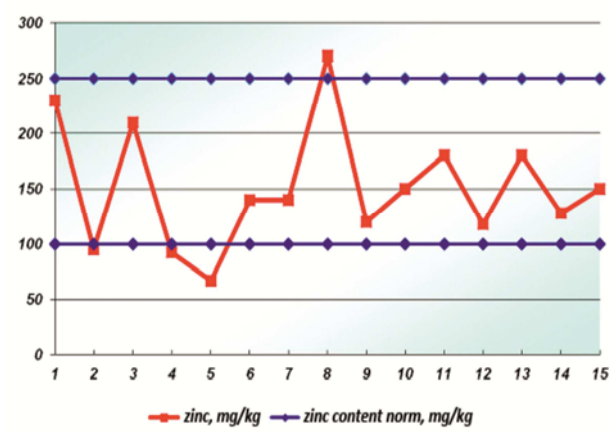

Fig. 3. The diagram of zink content in the hair of 15 test patients

As we can see from figures 1-3, the test patients have different contents of elements. This difference in content depends on the food, geographical position of the place where they study, work and live.

In the work "Ferrum monitoring of drinking water sources of northern regions" you can see research results of ferrum content in drinking water sources of northern regions.

The analysis demonstrates that in all drinking water sources there is an increase of TLV (Threshold Limit Value) of iron; so water from all these sources must be subjected to deferrization.

The chemical analysis of water from Siberian health resorts provides comparative analysis of experimental data on the content of microelements in reservoirs and salines of Siberian health resorts and waters from world-famous resorts "Yessentuki" and "Baden-Baden", and the Dead sea as well (figures 4-5).

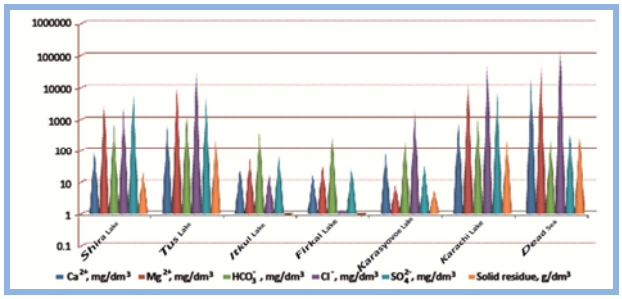

Fig. 4. The diagram of the contents of microelements in lakes

The presence of such diversity of natural and mineral water resources with different chemical composition gives the Siberians a possibility to replace world-famous mineral waters with local waters and get treatment in Siberian health resorts. Health centers of western and eastern Siberia with their variety of natural waters are not only as good as well-known southern and European sanatoriums, but are better than some of them.

Monitoring of natural environments should be performed annually; in this respect this annual work and further comparative analysis can be done by students.

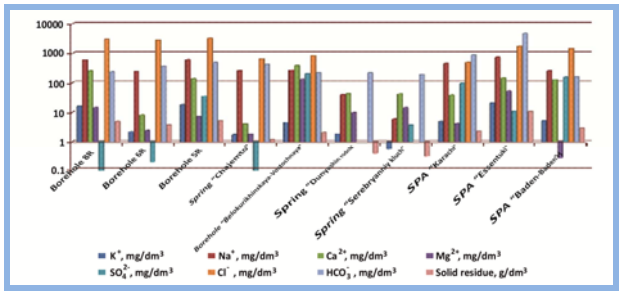

Fig. 5. The diagram of the contents of microelements in salines, wells and springs of health resorts

The analysis of natural environments comprises material, which is more effectively realized during students' research work. In our case, the regional aspect of the content of a chemical appears to be a factor both of chemical and ecological competence of students. A student acquires skills in conducting a chemical experiment and doing analytical works connected to analyzing natural environments. While doing his/her work, a student has a chance to obtain rich and vast information about ecological situation in the region [8].

The work is focused on the fact that a modern specialist must have a system-based vision, a set of general cultural and professional characteristics, including social and ecological competency.

Thus, *social competency* can be defined as the ability to take responsibility and make decisions; by the development of communicative skills in various cultural situations according to principles of tolerance, by respect to other cultures and universal human values. The given

task is reflected in the set of common cultural competences FSES in different majors.

An ecological competency can be denoted by the ability to take responsibility for professional activity based on the awareness of universal nature developmental laws [9].

The formation of a social-ecological competency, in our opinion, must be accompanied by the following elements: first, continuity of an educational process, which is conditioned by the modern situation of ecology in the world and in our country in particular. The situation is that it is necessary not only to spread and increase the level of knowledge, but to introduce ecological problems into mentality of people of the Earth as a whole and of each person individually. Second, promoting students' motivation to research and develop: it is even more important because the task is not only to educate a student, but to introduce a value component of careful attitude to nature into people's consciousness. Thus, we solve typical tasks of education and upbringing (overcoming ignorance and sluggishness of thinking, accumulation of knowledge, learning to set ecological problems).

It should be noted, that performing such kind of research reveals a research competency of both a student and a lecturer. For example, when a lecturer gives the task to a student and a student solves it, the lecturer not only "delivers" some theoretical information to the student, but teaches him/her the techniques to carry out research, which enables students to realize their intellectual and creative skills, broaden the mind, form the scientific view of the world. All these allow up bringing highly educated specialists and experts who will deal with ecological issues in the future.

Thereby, there is understanding of continuity of links between various spheres of knowledge, feeling of a holistic scientific picture of the world around, and the research itself is thought to be an essential part of the general process of cognition. Such work trains students to think independently, evaluate their activity and its results, which is critical for an individuality to realize opportunities for personal fulfillment.

Conclusion

The task to develop the above declared competencies must be achieved by performing scientific and educational activities. To put it in other words, the content of the techniques of students' research work should be adequate to the competency-based approach and provide the formation of competences (both common cultural and professional) which cannot be formed only by the content of disciplines.

The formation of professional readiness of future specialists is one of the important tasks in modern higher education. Acquiring competencies during the educational process, a student solves plenty of professional tasks using knowledge from different spheres of science. Hence, the most highly sought thing in education today is a complex approach to organization of scientific work that encourages performing social procurement and presenting education as self-fulfillment, development, orientation to the future, solidarity of a creative individuality and nature, revelation of creative and heuristic potential.

Thus, an interdisciplinary, system-based character of research work in the modern educational paradigm is aimed at solving innovation tasks of integrating educational, scientific and practice-oriented constituents in the context of the competency-based approach.

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