

TRAINING FOR CHEMISTRY OF THE STUDENTS OF MEDICAL AND BIOLOGICAL CLASSES IN PROFILE EDUCATION

Tatyana N. Litvinova

Kuban State Medical University (KSMU), Russia
E-mail: tnl_2000@inbox.ru

Margarita V. Solovyova, Elena D. Melnikova

PAEC (pre-academic educational center), KSMU, Russia
E-mail: MED2102@yandex.ru

Abstract

The problem of training for chemistry of the students of medical and biological class under conditions of profile education is raised. The authors propose program educational and methodical complex, which was introduced into educational process at the pre-academic educational center attached to Kuban State Medical University. The authors also proved the need to bring in the compensative approach under conditions of deficient preprofile training.

Key words: *profile education, chemistry, medical and biological classes.*

Introduction

On the contemporary stage of modernization of the educational system in the Russian Federation the transition to the profile education at senior school is proposed. It is one of ways to solve the problem of providing comprehensible qualitative general education, as well as to answer the individual educational students' needs. The present-day conditions require of a person, being occupied in any field, such qualities as an ability for quick reaction on changes, which take place in the society and in the environment, an ability to show high professionalism and sociability; and as for doctors they require such qualities as to be fast in his/her respond, to be decisive in taking measures and rendering assistance to save peoples' health and lives. To fulfil these requirements there is a need to reorganize the system of the students' training for entering to medical universities, as well as other universities with biological specialization. School chemical education has to be fundamental and at the same time diverse, variative, significant for personality and highly individual. These characteristics are necessary to raise the level of professional competence and to build up mental and moral principles of a future doctor. There is a need to create conditions for students' self-knowledge and self-actualization in the process of education.

Long-term experience of work in the system of school education attached to Kuban State Medical University gave us an opportunity to reveal a number of contradictions and problems of the transitional stage to the profile education. Therefore our goal is to create a methodical system of chemical profile education of the students of medical and biological classes. The system has to be appropriate to the process of modernization, to the contemporary demands and paradigms of education.

Methodology of Research

Starting from the posed goal we formulated the hypothesis: the training for chemistry of the students of medical and biological classes should be continuous, successive, professionally directed, it should be realized under conditions of the integration of medical universities with profile classes.

The methodological basis of the study is:

- The conception of the profile education at the senior level of general education; psychological and pedagogical research on problem of profilization of school education;
- The methodology of integrative approach in natural scientific education, as well as in chemical education;
- The methodology of selection and structuring of chemical education at profile school;
- The methodology of personal-activity approach in pedagogical researches;
- The didactic and methodological approach to the process of students' chemical education.

In our work we used both theoretical and experimental research methods, which are accepted in any works of pedagogical profile.

Results of Research

The gap between the level of school training for chemistry and the demands of higher education to the knowledge of university entrants is one of the most serious contradictions in medical education. Therefore universities including medical one, which are concerned about the quality of admitted candidates and the level of students' general education training, create there own systems of school training.

At the Kuban State Medical University (KSMU) with the direct assistance of the General Chemistry Chair the System of pre-academic training (SPAT) is created. It includes the Center of pre-academic training (CPAT), preparatory school attached to chair, extra-mural preparatory school, department of preparatory training attached to non-state medical institute (KMI) (Figure 1).

In the following system: **KSMU** \Leftrightarrow **SPAT** \Leftrightarrow **Associative schools** the university acts as organizational and regulative body, pre-academic complex acts as system-forming body, and associative schools – as filling-up body. KSMU gets the basic students' contingent of pre-academic education from these types of schools, engaging senior students from other schools as well as those who have already graduated.

Three educational blocks take the central place in the system of pre-academic training at KSMU. They are: chemistry, biological, and humanitarian.

When we evaluate the meaning of the training for chemistry of the students of medical and biological classes and when mold their motivation towards chemistry teaching we proceed from the fact that chemical education is an important constitutive part of general natural-science education and natural-science, ecological, culture. The latter is an integral characteristic of a personality. The chemistry, being a fundamental science, makes its essential contribution to the understanding the contemporary view of the world. It is an integral part of all mankind culture. Sustainable development of a society is connected with the technological progress and the development of chemistry in human life support, which takes place on the following fundamental strategic directions: energy, materials, provisions, medicine, and health protection. And so the chemistry is not only an important fundamental science, but also necessary educational subject.

This conclusion is based on “deliberate understanding the fact that chemical compound (chemical substance) serves as main corporeal material reality, which is situated at the heart of the most important fundamental transformations and evolutional processes on the Earth” (Sirotkin, 2000). Chemistry makes its contribution into understanding decrees of nature, into scientific ideology and human thought. It also contributes into creation of the material base,

including medicinal and medical equipment. Knowledge of chemistry serves not only as an element of culture, but also as an essential condition of human existence in its environment. Chemistry teaching lets to mold dialectical view on chemical state of matter motion, to reveal material basis of the environment, to give necessary knowledge for understanding the essence of global present-day problems, such as: ecological, rough-material, power, provisional. It plays also a big role in upbringing the ecological and valeological culture. This is because these problems are based on chemical nature; chemical tools and methods take place in the solution of most of these problems.

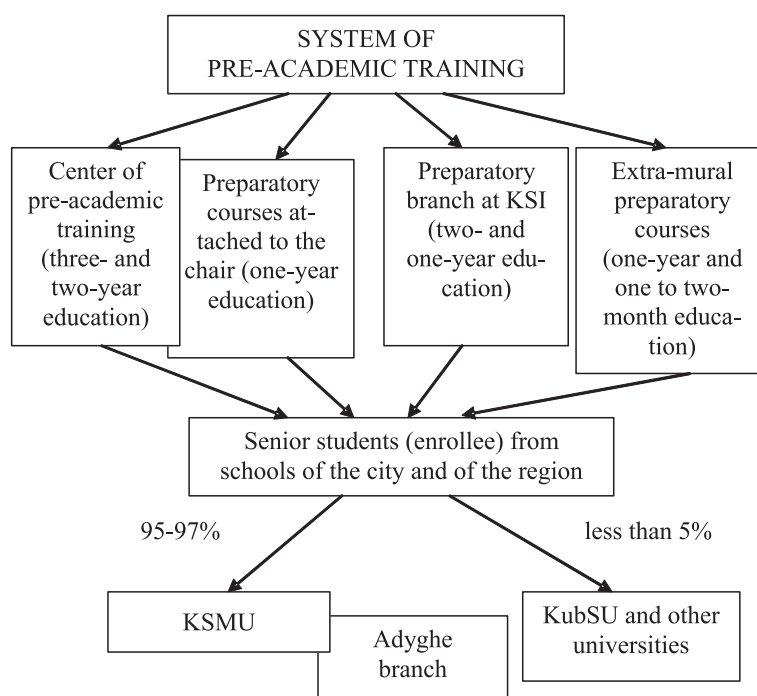


Figure 1. Scheme of the system of pre-academic training attached to KSMU.

The meaning of chemistry subject for further education is obvious also because it not only equips students with theoretical and applied knowledge, but also has broad possibilities for development diverse skills, intellectual talents (thinking, logic, memory, an ability to apply knowledge in real life, etc.). All these characteristics are of a great importance in formation of medical professionalism. Chemistry being a fundamental branch of science also play an important role in the process of molding personality of a senior student who not only obtain knowledge and skills, but also serves as humanist, capable for compassion.

Main goals of pre-academic level of chemical education we consider to be conscious, systematic and efficient learning of the curriculum chemical course, realization of the developing opportunities of interdisciplinary links, perfection of the conduction of students' problematic and search activity on the basis of professionally directed principle. These agrees with the definition of the profile education: "Profile education is a mean of differentiation and individualization of education, where at the expenses of changes in the structure, content and organization of the training the following aspects are given proper weigh: students' interests, inclinations, and capabilities; as well as conditions for education of senior students in compliance with their further education. Profile education is directed towards realization personal-directed educational process" (Kuznetsov, 2007). In the Conception of profile school the following problem is set: to create conditions for differentiation of the education content of the seniors which will give broad possibilities for building individual educational programs. We consider that the program and demands to the knowledge and abilities of medical university enrollees should take into account specifics of a given profession, should be aimed at revealing not only knowledge, but also ability to apply them, to use them in irregular situations, to think logically, to analyze, which is necessary for future doctor.

The main goal of chemical education at medical and biological classes is a fundamental

chemical education based on principles of professional direction and rational minimization. Unification and standardization of the chemistry program content (profile level) conflicts with medical and biological orientation of chemistry teaching in the system of pre-academic education attached to medical universities, in medical and biological schools.

On the base of thorough preliminary research of seniors' knowledge, defects of educational school system, as well as with the demands of medical universities we worked out a program. It is notable for its structure, ascents, and substitution of a number of problems inessential for medical university with more meaningful one, which are marked with definite motivational components and directed professionally. Author's educational program is a part of program educational methodical complex, which is created by us. Various syllabuses for different forms of training, chemistry training aids, system of exercises for SPAT students, methodical recommendations, tests, requirements to the level of training and scope of students' knowledge in chemistry, syllabuses for elective courses were included in this program. Author's educational program on chemistry is characterized by medical and biological, ecological, and valeological orientation. In the process of chemical education in the system of SPAT we pay special attention to the questions, which of a high importance in the course of general chemistry and chemistry of living at a medical university (Litvinova, 2004; Litvinova & Ajipa & Solovyova, 2003). However with the advance of the Unified State Examinations and with the participation of the KSMU in this experiment demanded the correction of the syllabus content towards its unification and, thus, towards minimization of its profileness.

For more effective chemical education of the students of profile classes there is a need to bring syllabus into accord with curriculum. Two years of the chemical profile education should be based on the becoming training of the pre-profile level for not to create an overwork of both students and lectures. Whereas school hours, marked out for chemistry, should be sufficient and adequate for achievement of goals.

At present time the transition to the profile education on the senior level of secondary school does not adjust with the amount of school hours (210 hours), marked on the mastering of syllabus for secondary (completed) general education on chemistry (profile level). It also does not adjust with the level of preparation for understanding of a complex abstract chemistry material. To the given program and to the federal component of a state standard to a secondary (complete) general education difficult for students' understanding theoretical questions are included, such as concept of enthalpy, entropy, activation energy, electronic theory of atom structure and others.

Our experience of work with students at SPAT makes it clear that without corresponding pre-profile training for chemistry, as well as for math, the program of chemistry could not be realized within 210 hours. At CPAT there are 256 hours for chemistry learning, and 60 hours for elective learning. There is also a need for correction of the approximate program towards diminution of the content volume of the fact material, which in most cases is not claimed in the process of pre-academic education.

In 2006 we tested the 9th grade students based on syllabus of non-organic chemistry (Surovtseva & Guzei & Ostannii & Tatur, 1997). The results of the answers on the controlled elements of knowledge shown, that 85% of students were not able to solve problems on calculating heat effect of chemical reaction. The knowledge of properties of carbon, silicon and their compounds is lacking among 80% of students. Whereas 77.5% of students were unsuccessful in the task on electronic structure of atom of chemical elements, did not understand types of chemical bonds, can not solve simple calculation problems. Total rate of 30 students out of 40, those being tested, amounts less than 45%. It is interesting to mention that in spite of such a low level of knowledge and abilities in chemistry 90% of senior students made their choice to study at medical and biological classes independently. And 65% have a positive attitude towards chemistry, realize its meaning in human life as well as in future profession. These facts are evidence of existence of a serious problem in pre-profile education. The reduction of school hours on chemistry learning, lack of equipment of chemistry laboratories contribute to formal attitude towards chemistry learning, lead to lack of experimental and calculation skills, and, therefore, result with the decrease of students' motivation and interest to study chemistry.

The lack of basic chemistry skills among 9th grade students does not let to realize profile education without paying enough attention towards filling gaps of students' knowledge. This

requires not only additional students' and lectures' time, but also additional methodical work, oriented on the development of conscious, systematic and actual learning of chemistry, realization of developing capacities of interdisciplinary bounds. Besides, during such strained learning process the students become overworked, because they have to cover material of both pre-profile and profile level within two years.

In the environment of deficient pre-profile training we assume to apply a compensating approach, which should be directed:

- to reveal gaps in students' knowledge and skills;
- to its effective and rational filling up which should support conscious learn of profile level syllabus based on cooperation of co-authorship "teacher-students", the individualization of this process;
- to achieve the professionally directed principle of chemistry teaching, to realize of chemical education role in life and in further education, to strength motivation of chemistry learning;
- to form a stable interest towards gaining new knowledge, towards future professional activity.

The correct choice of educational methods (Figure 2) and forms of curriculum organization serves as determinative factor to achieve posed goals. From the position of activity approach following Babanskii Y.K., Lerner I.Y. Schukina G.I. and others we consider methods of general chemistry learning as means for realization interconnected activity between a lecturer and a student, which is directed towards achievement of posed goals and tasks. Often being transformed into methodical techniques of lecturers and activity means of students these methods and techniques serve as an important condition of productive and effective educational process. In environment of chemistry teaching didactic methods are tightly bounded with scientific chemistry methods of perception. The determination of a variety of methods applied to the process of chemistry teaching is determined by the goals of its teaching, by diversity of character and types of activity in the process of teaching. Methods of chemistry teaching are an integral component of educational process in which they are connected with other components into unified methodical system.

During educational process of chemical pre-academic education we apply a complex of methods, which activate educational and cognitive students' activity. We feature chemical experiment, interpretation of experimental data, solution of cognitive problems of different types, including calculated chemical ones, and problems with medical, ecological content, demonstration of visual material (schemes, models), and unity of theoretical and empirical methods in formation of fundamental concepts and laws.

We pay attention to stimulation of teaching methods. These techniques are connection between studying material and life and medical practice, revealing the importance of chemistry, and some of its problems for medical education, insertion of historical material and interdisciplinary problems. The results of our research adjust with the data of researches of other methodologists (Guzeev, 2001; Minchenkov, 2000; Titova, 1999) and others.

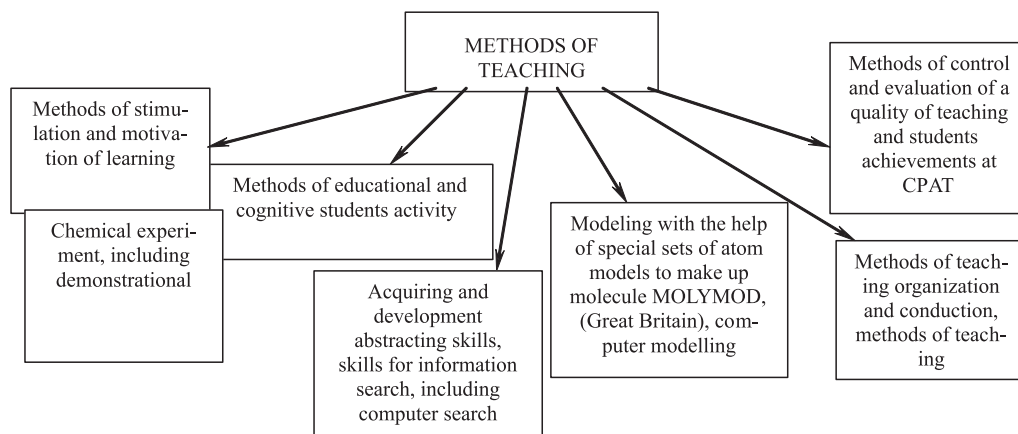


Figure 2. Methods of chemistry teaching of medical and biological students.

Another important methods of teaching at CPAT are independent work with materials, abstracting, skills of informational and computer search, test work – all of them play essential role in university education.

Lectures on all branches at CPAT are 2 hours long. We take into account that students attend both school and KSMU, as well as specifics of their age and fatigability. Therefore lecturers treat the problem of attention maintenance seriously. To concentrate attention on learning the following techniques are used: “drawing attention” and “visualization”. Psychological peculiarities and psychology of education are taken into account. The important instrument of solution of attention problem is switching over to other activities. The leading tool for stimulation of interest is chemical experiment. Combination of visual, graphic and theoretical education influences the inclusion of work of left and right cerebral hemispheres and help students, who have lack of conceptual and theoretical thinking, to learn chemistry (Dubrovin & Kruglov, 1988).

Distinctive organization feature of pre-academic education is systematic character of various types of control which is called monitoring. It is based on regular feed back, on diverse control of material learning (express diagnostics, test control, oral test, written self-checking control work, and control works on general topics). The peculiarity of our test control is inclusion of students’ arguments of given answers. This excludes guesses and demonstrates level of mastering and degree of understanding of a question. At the same time students are active in self-analyses and self-control of their achievements. Such approach gives a possibility for a lecturer to view the more complete picture of question understanding, of mastering of knowledge and skills. And also it gives an understanding to evaluate students’ achievements and their ability to carry out correction work.

We emphasize the elective education at specialized medical and biological classes. A fundamentally new elective “Electronic effects in chemistry” course was introduced by us. It is aimed at inter-profile specialization of education, at building of individual educational trajectories, as well as at formation and development of systematic students’ conception of organic and non-organic matters, which are separately studied at school, and regularity of dependency their properties on electronic structure. The subject of the elective course is chosen deliberately. This is because understanding electronic effects is necessary for students to understand reaction abilities of matter, and therefore it is necessary for prediction of their behavior in diverse reactions. Properties of substances and their possibility to be used in biology and medicine, in everyday life and production depend on their electronic structure.

Conclusions and Discussion

Creation of scientifically grounded methodological system of students’ training, organization of the educational process under the patronage of medical university, which accounts together with a school the quality of pre-academic education on profile disciplines – everything serves as indispensable and important condition for medical and biological students’ education.

Acknowledgements

We express our thanks to Fedosova L.F., the methodologist of the Natural-Science and Ecological Education chair of Krasnodar Regional Institute of Complementary Professional Pedagogical Education for reviewing the program educational methodological complex and for the organizational and consultative help in the work with lecturers and teachers of schools of the city and Krasnodar region.

References

- Guzeev, V. V. (2001). On planning of personally oriented education. *Khimiya v shkole*, 6, 27-35.
- Dubrovin, M. V., & Kruglov, B. S. (Eds.). (1988). *Peculiarities of education and psychological development of school students 13-17-years old*. Moscow: Pedagogica.
- Kuznetsov, A. A. (2007) Profile education: goals, forms, structure of a curriculum. Retrieved May 15, 2007, from <http://www.profile-edu.ru>
- Litvinova, T. N. (2004). Profile education in the system of pre-academic training. *Profilnaya shkola*, 3 (6), 42-45.
- Litvinova, T. N., & Ajipa, L. T., & Solovyova, Y. N. (2003). Pre-academic education as a connecting-link between school and university. *Khimiya v shkole*, 3, 51-55.
- Minchenkov, Y. Y. (2000). Perfection of skills to realize mental work. *Khimiya v shkole*, 1, 10-16.
- Sirotkin, O. S. (2000). Contemporary conception of chemical education (Chemical education in XXI century). In: *Chemical education and development of society. International conference (October 11-13, 2000. Moscow, Russia)*, 56.
- Surovtseva, R. P. & Guzei, L. S., & Ostannii, N. I. & Tatur, A. O. (1997) *Tests: Chemistry. 8-9 grades*. Moscow: Drofa.
- Titova, I. M. (1999). Development of motivation for chemistry study. *Khimiya v shkole*, 1, 10-16.

Advised by S.P. Grushevskiy (Грушевский С.П.), Kuban State University, Russia.