the science classroom. Our problems are essentially social, economic and political. The community of chemistry educators in Brazil has made great strides in terms of the theoretical debate, analysis of the educational reality, proposals for alternative methodologies in scientific production, all of which will be insufficient if major policy decisions are not taken on issues, such as an increase in the GDP (Gross Domestic Product) allotted to Education (currently being discussed in congress), appreciation of the teaching profession and improved school infrastructure.

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# Chemical education in Russia: features and tendencies of development

# Enseñanza de la química en Rusia: características y tendencias de desarrollo


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***Abstract***:
*The article reveals the essence of chemical education in Russia as a continuous process. Continuous chemical education implements 3 main stages, each with its own peculiarities and tendencies of further development. Before academic stage implements 2 levels of education: 1) the stage of basic school (grades 7-9), 2) the stage of secondary school (grades 10-11). The academic stage provides: 1) the level of a bachelor degree on preparation of the bachelors of chemistry and bachelors of chemical education, 2) the level of master's training of masters of chemistry and masters of chemical education, 3) specialties for preparation of chemistry teachers. After academic stage provides: 1) the graduate school for the training of candidates of the chemical and of pedagogical Sciences, 2) doctoral studies on the preparation of the doctors of chemical and pedagogical sciences, 3) institutes of improvement of chemistry teachers professional skill. The update trend at all stages is provided with their interaction.*



***Keywords:*** *continuous chemical education, stages, features, tendencies of development.*



***Resumen***
*El artículo revela la esencia de la enseñanza de la química en Rusia como un proceso continuo. Enseñanza de la química continua implementa 3 etapas principales, cada una con sus propias peculiaridades y tendencias de desarrollo futuro. Antes de la etapa académica implementa 2 niveles de educación: 1) la etapa de educación básica (grados 7-9), 2) la etapa de la escuela secundaria (grados 10-11). La etapa académica dispone lo siguiente: 1) el nivel de una licenciatura en la preparación de los licenciados de la química y la licenciatura de enseñanza de la química, 2) el nivel de formación de maestría de los maestros de la química y maestros de la enseñanza de la química, 3) las especialidades para la preparación de la química de los profesores. Después de la etapa académica dispone lo siguiente: 1) la escuela de postgrado para la formación de los candidatos de la química y de Ciencias Pedagógicas, 2) los estudios de doctorado en la preparación de los médicos de las ciencias químicas y pedagógicas, 3) los institutos de mejoramiento de la química de profesores con una habilidad profesional. La tendencia de actualización en todas las etapas se proporciona con su interacción.*



***Palabras clave****: enseñanza de la química continua, las etapas, características, tendencias de desarrollo*


## INTRODUCTION

Knowledge of the peculiarities and tendencies of development of chemical education in different countries will allow us to considerably enrich (and update) the content and methodology of national education, through the drawing of progressive ideas, of educational technologies, philosophy of education, used in these countries.

What are the similarities and differences in methodology, theory and practice of modern chemical education in some countries of Latin America, Europe and Asia? The answer to this complex question can be given by installing, first of all, peculiarities and tendencies of development of modern chemical education in these countries.

Chemistry in Russia is studied in primary (grades 7-9), and in the secondary (grades 10-11) school, as well as in various higher educational institutions. Therefore, a modern Russian chemical education is a continuous education, a complex integrative process that has a certain stages, bases, levels, components.

## CONTINUOUS CHEMICAL EDUCATION

Continuous chemical education is considered as *a process and result* of the assimilation of students: 1) scientific knowledge of the chemical objects of the surrounding world, 2) specific subject and generic skills, competences, 3) the axiological style of thinking, experience of creative activities, 4) the value of the relationship to the chemical and non-chemical objects, spiritual values, 5) as well as the readiness for further chemical education and self-education.

*The main functions* of chemical education as a major component of the natural science education are the following:

1. To provide students with a holistic chemical paintings of nature, the fundamentals of chemical sciences, - *the knowledge systems of chemical objects* of the surrounding world (the chemical elements, substances, chemical reactions and processes, chemical technologies and industries), about the most important chemical *concepts, scientific facts, laws, theories, the chemical language and specific methods* of cognition of chemical facilities, about the *contribution of outstanding chemists* of the world in science, technique and technology;

2. *Provision of personality-oriented teaching chemistry*, aimed at maximum disclosure and use of individual psychological students' peculiarities (of perception, thinking, memory, emotions, will, needs, cognitive biases, interests, motivation);
3. *The preparation of students for life* in a constantly changing socio-economic conditions, training to *continuing education and self-education*.

With these main functions connected the main trends of the deployment process of chemical education.

Continuous chemical education is one of the forms of specific systems (I.V. Blauberg, V.N.Sadovskiy, E.G.Yudin) that is ordered in a certain way many components, interconnected and form *a complete unity. Updating* of the pedagogical system (N.V.Kuzmina) is *one of the trends* of development of continuous chemical education.

Chemical education is one of the forms of the specific didactic systems that solves simultaneously three groups of tasks (training, education and development) in the study of chemical facilities. Updating this form of didactic system is one of the trends in the development of continuous chemical education.

Chemical education is a *process and the result* of the formation of scientific knowledge about the chemical objects of the surrounding world, the subject, skills and competencies, as well as the value of the relationship. *Updating of the process and results* of chemical education is one of its trends.

Continuous chemical education is ensured by the implementation in the educational practice of the structure and content of chemical education, which meets modern educational standards of the new generation, performing the functions of the model, the standard and quality meter of chemical education. The update of the modern continuous chemical education is difficult to imagine without the realization of ideas of pedagogical innovations.

As a reference in the development and implementation of the update of the system of continuous chemical education is advisable to use the *key attributes of innovative education* (*V.F. Vzyatyshev , L.I.Romankova, 1998)*:

1. the main task of the educational activity - *the knowledge of a future of world and the creation of the present* (but not the knowledge of the existing world and creating the future);
2. methodology of educational activity - *the theory of practice* (and not only the scientific method and formal logic);
3. *the admissibility of the set of options* (and not the uniqueness of the solution of educational tasks);
4. *the multiplicity* of (but not unique) criteria for the evaluation of the results (spirituality, accuracy, usefulness, safety, efficiency etc.);
5. direction to the *harmonious co-development* of the person with the outside world (and not only of the knowledge, abilities and skills, but also the value relations, meanings, motives, emotions).

*Innovative processes* in continuous chemical education presuppose implementation of *innovations* in the content, and the organizational and methodological mechanisms of the educational process, in the teaching of chemistry, as well as a creation of conditions for the transition of the system to a new qualitative level. Such *conditions* at the present time can be: 1) the use of *the paradigm of innovative education*; 2) the *exploratory nature* of the educational activity of teachers and students; 3) the maximum realization of the *spiritual needs* of a human; 4) formation of *universal research and creative skills*; 5) development of social and cognitive *important motives*; 6) *integration* of different types of activities (educational-cognitive, research, employment, practical, aesthetic, games, innovation, pictorial and graphic, communicative, scientific, experimental, etc.); 7) *new educational standards* (http://standart.edu.ru). These conditions may provide modern (traditional and innovative) *humanitarian technologies* It is important to recognize and take into account the typical features for *innovative chemical-educational technologies*.

It should be noted that in the practice of chemical education various training methods and educational technologies are actively used (full assimilation of knowledge, integrative-modular, test, dialogue, explanatory-illustrative, interactive, etc.).

In continuous chemical education all of its *stages of development* require updating: 1) general secondary education, 2) higher professional education, 3) post-graduate education.

## GENERAL (PRIMARY AND SECONDARY) CHEMICAL EDUCATION

General chemical education is being implemented in Russia in the primary (grades 7-9) and secondary school (grades 10-11).

A traditional content of the school chemistry course is reflected in the topics of its sections. See example. *Class 8 (2 hours per week)*.

T1. The initial chemical concepts.
T2. Oxygen. Oxides. Combustion.
T3. Hydrogen. Acids. The Salt.
T4. Water. Solutions. The Base.
T5. Generalization information about the most important classes of inorganic compounds.
T6. The periodic law. The periodic system of chemical elements (PSCE) D.I. Mendeleev. Structure of the atom.
T7. The chemical connection. The structure of the substance, etc.

Restructuring following the demise of the Soviet Union, the absence of the Soviet system of secondary education led, in the view of the authors (*G.V. Lisichkin, I.A. Leenson, 2011)*, to *tragic consequences* for chemistry education in secondary schools. According to them, the following are the *dramatic changes* that have occurred in Russia:

- ✓ a sharp decline in the prestige of education, especially natural-science;
- ✓ liquidation of a single educational space, decentralization of school education;
- ✓ the emergence of new educational plans, implementing a minimum of natural-science disciplines;
- ✓ unfair competition between the numerous parallel textbooks;
- ✓ a requirement of graduation tests on natural-science disciplines;
- ✓ the general lack of laboratory practical work in schools:
- ✓ homophobia, actively advocated by the mass MEDIA;
- ✓ the flow of mystics, of darkness and of pseudoscience on TV, in the Internet, in Newspapers, radio broadcasts;
- ✓ active the propaganda of religion and, therefore, dogmatic thinking.

Such advantages of the Soviet system of General education, as the fundamental nature, consistency, accessibility, free of charge education are difficult to maintain in an era of social change. A different approach is required for setting the goals of education, the selection of the content and the evaluation of the results of chemical education.

The effective formation of the local chemical pictures of nature implies the implementation in the process of General education (primary and secondary school) of five main stages (M.S.Pak, 2001):

1. a *wildlife* stage of formation of elementary chemical information (classes 1-4
2. of the primary school);
3. *scientific* stage of disclosure of chemical aspects of the biology, physics, geography (classes 5-6);
4. *preview* stage of the study of chemistry course "Introduction to chemistry" (class 7);
5. the *basic education* stage of learning the basics of General, inorganic and organic chemistry (classes 8-10);
6. *initial-professional (profile*) stage of training in chemistry (class 11).

The content and process of general chemical education is built on the basis of *the leading ideas*: 1) *material unity* of substances of a natural (living and non-living) nature and materials, man-made and used in engineering, technology and everyday life; 2) *the relationship and interdependence* between composition, structure, properties of substances and materials) and their application in engineering and technology; 3) *the development of chemistry and chemical industries* under the influence of the cultural-educational, scientific-technological and socio-economic progress.

Updated content of modern chemical education in secondary school should be *integrative*, in structure of which there is *invariant kernel*, the Federal state educational standards of new generation, and *malleable-profile content*, the educational needs of the region and school.

Invariant core content of chemical education is the main part of the school subject of chemistry. It includes the most important system of chemical knowledge, adequate scientific knowledge, and the reflection

the chemical objects of the world, also chemical bases of raw material, materials, equipment, technology, and economics of production, safety, health and environment.

Malleable-profile content includes the *most important social and vital knowledge*, ways of activity and the value of the relationship. It reflects the tendencies of personality-oriented teaching of chemistry, the idea of democratization, humanization and innovation in chemical education. Variability of content can be *determined by*: 1) personality-oriented teaching of chemistry that takes into account the individual student's cognitive abilities, inclinations, needs, interests and abilities; 2) the profile of the subject teaching, specified the principles of democratization and differentiation in education in the school; 3) national-regional principle of subject teaching; 4) current socio-economic order of the society; 5) the global problems of today, the solution of which is reflected in the contents of modern chemical education. Variability of the content of the training programs can be represented by *diffusion* (in conjunction with the invariant content) or the *block-modular* (separate unit with modules).

Implementation of the invariant and varied content of chemical education takes place by means of the integration processes. Special attention is paid to the theory and practice of chemical education *integration processes, mechanisms, types, levels, forms, directions of integration, the "floor" of integration, methodological synthesis*, as well as the *regularities* of the processes of integration. Such laws, which are considered as the regularities of formation of integrity (M.S.Pak, G.N.Fadeev, A.N.Lyamin), include: 1) the conditionality of integration processes of the unified system of activities (of knowledge, work and communication); 2) the integrity of the investigation of the chemical and other objects of knowledge; 3) the logic of the subject of chemistry formed on the base of systemic approach and others.

The *transformation* of the invariant chemical and malleable-profile content in the formed system of fundamental and mobile, social and vital knowledge, integrative skills, and the experience of cultural activism is carried out by means of modern information-methodical support, based on *the innovative processes and humanitarian technologies.*
These processes are connected to the analysis, abstraction, generalization, aggregation, integration, synthesis, comprehension of the results of the synthesis, systematization, with the *overcoming of difficulties* in mental actions, as well as in the practical application of the system of knowledge, universal skills, values-based relationships in a continuous *knowledge* (academic and research), in *communication* (business and personal), in the *labor* (academic and industrial) and in a safe *life*.

*Measurement* of the efficiency and quality of chemical education is carried out with the help of *complex of level estimation guaranteed results of education* by means of appropriate *criteria* (quantitative and qualitative), *indicators and parameters* that determine the completeness, consistency, focus knowledge, the universality of skills and readiness for further chemical education and self-education, to safe life activity.

*Control over the quality* of the process and results of chemical education require the use of *stratification and a complex* of different (for knowledge, skills, competencies, experience, values-based relationships, personality traits) *methods of analysis and evaluation.* The latter include: 1) the component analysis (V.I.Rostovtseva, 1967) and the functional analysis (A.V.Usova), 2) the use of tests in chemistry of various types (M.S.Pak, 2001), 3) statistical methods of processing of academic achievements, 4) graphical and tabular methods of presenting the results, 5) the questionnaire, 6) scaling, 7) the didactic experiment, 8) pedagogical observation, 9) studying of experience of teachers of chemistry, 10) interview, 11) longitudinal method, etc.

Achievement of the main goal of common chemical education is connected to the account and the overcoming of the three major barriers: a *methodological, axiological and informational.* These barriers draw the attention of A. A.Makarenya.

These barriers exist in different levels of the education (student-teacher and student-student, student-parent, teacher-teacher, teacher-parent, teacher-methodologist, teacher-Minister, etc.). Methodology, values and information, which are used by the subjects of education, diverse, can be contradictory, are the alternatives. *Tolerant attitude* to them is an essential condition of successful solution of the tasks of the *update* of the chemical education.

## HIGHER CHEMICAL EDUCATION IN PEDAGOGICAL UNIVERSITIES

Higher chemical education in pedagogical universities (or *chemo-pedagogical education*) is considered as a *process and result* of the formation of the subjects of education (bachelor's, master's, specialist, graduate and doctoral levels) *readiness* of the chemist-the teacher for the professional work, life, further continuing education and self-education. *The main goal* of chemical-and-pedagogical education is the *formation of* chemically well-educated, culturally advanced spiritually, creative, professionally *competent person* (bachelor or master degree in chemistry, a candidate or doctor of chemical Sciences, teacher of chemistry, bachelor's, or master's degree of chemical education, the candidate or the doctor of pedagogical Sciences), capable to work in a constantly changing socio-economic, scientific-technological conditions of educational space. Students study various chemical (*General, inorganic, organic, physical, analytical, biological, colloidal chemistry, chemical technology, environmental chemistry, etc.)*, *psychological-pedagogical, didactic-methodical* and other disciplines. *The main directions of the update* of the higher chemical-pedagogical education:

- ✓ the *implementation of a new integrative-contextual concept* (M.S.Pak, 2001) based on the modern philosophy and methodology of education;
- ✓ accounting *paradigm of innovative education* with its key characteristics;
- ✓ implementation of the system of the leading principles of education (leveling, consistency, comprehensiveness, orientation, competence, polyfunction, continuity, unity integration and differentiation, didactic polysemy);
- ✓ *streamlining and integration* of invariant and malleable-profile content education, their comprehensive implementation;
- ✓ *use of the regularities* of the processes of integration, of various types, forms, levels, stages and directions of integration of the content of chemical-and-pedagogical education, scientific-methodical support;
- ✓ optimization of organization and carrying out of professionally important *pedagogical practices* (study, methodical and probation, scientific-pedagogical and scientific-research);
- ✓ *measurement and evaluation of quality* of education (*G.A Bordovskiy., A.A Nesterov., S.Yu. Trapizyn, 2001)* by means of a comprehensive level methods of control, analysis and evaluation of the chemical-pedagogical education, adequate him of criteria, indicators and parameters that determine the readiness for professional chemical-pedagogical activity, to further education and self-education.

One of the most urgent problems in the theory and practice of chemical education is still the problem of the formation in high schools of professional competence of the chemist (the chemist-teacher). In the theory and methodology of teaching chemistry drew attention to the necessity and possibility of the formation of the students (vocational, professional-methodical, pre-professional, and communicative) competence (I.L.Drizhun, I. B. Kuanysheva, M.S. Pak, R.Gmoch, A.N. Lastochkin, M. M. Kotlyar, 1991-2000).

The *Federal state educational standard of higher professional education* of the new generation in the preparation of, for example, the bachelors on a *direction 050100 - Pedagogical education* provides for the formation of 16 cultural, 6 of General professional and 7 professional subject related competences (http://fgosvpo.ru). The state standard, it should be noted, should perform the functions of *models, standard and meter* in the educational process.

Accepted group of competence of the *key* (for all occupations), *basic* (for pedagogical and educational activities), the *specific subject* (for a certain subject area, for example, in the teaching of chemistry), *universal* (for different objects and functions; for chemical education).

The level analysis proposed by I.L.Drizhun with the purpose of estimation of professional competence of the teacher of chemistry is interesting. In his professional qualifications of chemistry teacher he distinguishes 6 levels of professional activity in order to "reduce" the competence of:

(5) The teacher constantly strives for self-education, to self-development, creativity and implements these aspirations. He creatively decides educational tasks, using new methods, forms and methods of organization of educational activity (innovation).

(4) The teacher owns the previously described developments (skill). At the same time for himself, he can do the "open ", not to enrich the science and practical experience.

(3) The teacher owns the subject and psychological-pedagogical knowledge and skills in a general way, about uncertainly.

*(2) The teacher does not possess the necessary knowledge, skills and experience difficulties in the professional-pedagogical activity.*

*(1) The teacher does not possess the knowledge, skills and allows significant error.*

*(0) The teacher is internally "closed" for professional development. He does not possess the necessary knowledge and skills and is not seeking to their mastering.*

Levels, designated by I.L.Drizhun, clearly illustrate the possible "format" standard, performing the functions of the model, the standard and of the meter. The verbs "owns" and "not owned" "measure" the level of competence. If the teacher does not possess chemical knowledge, subject skills and does not seek to master, it internally closed for professional development. Such a teacher is on *the level of competence of 0*.

It should be noted that the teacher of higher educational institution that shapes the students of the competence, should be professionally competent. The most optimal formation of professional competence among the students can carry out the teaching staff of like-minded people (not only methodist, but also social pedagogues, philologists, chemists, cultural scientists, technologists, sociologists, etc.).

Possession of the student in the process of a special ("chemical") and professional-methodical preparation of the above competencies in many respects depends on the professional skills and innovation of the University teachers holding the modern philosophy and priority orientations of education (*I.Y. Aleksashina*), the substantive content and effective technologies of diagnostics, monitoring, control and evaluation of the quality of chemical-educational process (*V.P Solomin, M.S. Pak, S.M. Shilov, J.J.Gavronskaya*).

## CHEMISTRY EDUCATION AT THE POST-GRADUATE STAGE

Update on the post-graduate stage of continuous chemical (or chemical-pedagogical) education is connected with the increase of the level of professional competence of the teacher of chemistry. Employees of Institutes of development of education, Institutes of advanced training and professional retraining of workers of education, University of pedagogical skills, the Academy of post-graduate pedagogical education should already at the planning stage of the program of qualification improvement of chemists-teachers (specialists, bachelors, masters) provide for the examination of issues related to the development of professional pedagogical competence, formed at the University.

It is necessary to define a *circle of issues*, which must be knowledgeable of modern professionally competent chemist-teacher (the teacher of chemistry, master of chemical education, etc.

*Universal competencies*, which must master chemist-teacher (the teacher of chemistry, a chemist, a methodist of bachelor and master of chemical education) are, in our opinion, the following (M.S.Pak):

*socio-pedagogical competence* - range of issues on which we have knowledge and experience, allowing the optimal set appropriate socio-pedagogical contacts with other subjects of the educational process (students, other teachers, parents, Methodists), interact with them, to take the high moral attitude to them, regulate or in a timely manner to eliminate possible conflicts, to participate in scientific and practical events of his professional community;

*subject-educational competence* - range of issues on which we have knowledge and experience, to ensure the quality of the chemical and of the educational process, educational achievements, further education and self-education;

*linguistic-communicative competence* - range of issues on which we have knowledge and experience, allowing in professional activities and in the life of both orally and in writing to communicate, mastering the native and foreign languages, natural and machine languages, language and the language of programming, languages, Sciences, in particular, the chemical language;

*information-technological* competence - range of issues, on which there is the knowledge and experience to successfully use in their professional activity of a modern (traditional and innovative educational technologies, skillfully filtering out unnecessary information, received in the educational environment from the MEDIA and from other sources;

*spiritual-cultural competence* - range of issues on which we have knowledge and experience, allowing delicately interact with other subjects of education, with the representatives of other cultures, countries, religious confessions, a tolerant attitude to other traditions, norms, customs, ceremonies, events, holidays, to other peoples, nationalities and races.

In the system of higher education established the following levels of (4, article 15 "the Structure of the education system"): bachelor's, master's, specialist training, training scientific-pedagogical personnel.

Special attention should be updating the content of training *scientific-pedagogical personnel of higher qualification in postgraduate and doctoral studies*.

The content of the invariant part of the professionally-methodical preparation of post-graduate students - chemists of the scientific specialty 13.00.02 (theory and methods of education and upbringing), open the corresponding program (M. S. Pak, E. G. Zlotnikov, A. A.Makarenya, N. N. Surtaeva, T. S. Nazarova), requires the update. The *update to the post-graduate level* require: 1) the basic professional educational program of post-graduate professional education on a scientific specialty 13.00.02; 2) training programs for compulsory and optional subjects, disciplines at the choice; (3) programs of pedagogical practices; 4) the program of scientific-research work of post-graduate students; 5) the exam on the specialty in accordance with the theme of research of each post-graduate student.

An update of training scientific-pedagogical personnel of higher qualification should be based on *acmeological principles*. (Pak, 2001 *)*. The acmeological framework include: 1) *knowledge of acmeology* - a science studying and implementing laws, principles and terms of the achievement of man "Acme" in his life); 2) integrative methodology, in the infrastructure of which the various methodological approaches from A to Z (activity, bilingual, complex, dialogue, humanitarian, value, valeological, etc.); 3) the principle of creation motivational sphere of the subjects with a strong personal sense of education; 4) a new understanding of the quality of education in the form of competence; 5) personality-developing technologies.

### Interaction in the sphere of chemical education

*Interaction* of secondary and higher school in the field of continuous chemical education is regarded as:

*1) the process* of direct or indirect consequence of the impact of high and higher schools at each other, generating their mutual causation and correlation; 2) *the form* of the progressive renewal of the modern system of continuous chemical education; 3) condition for the quality of the process and the result of continuous chemical education.

Varied the objectives, content and forms of interaction between the secondary average and the higher school. They are associated with such notions as a small Department of chemistry, the chemistry Olympiad of schoolchildren, additional chemical education, extraordinary work in chemistry, excursions, courses of improvement of qualification of teachers, scientific-practical activities, thematic seminars, round tables, certification of teachers, anniversary dates, open lectures and classes, pedagogical practices (scientific-research, scientific-educational, methodical, internship, research-based training) and others.

The interaction of the schools is built on the basis of the *principle of continuity*, the pedagogical and didactic levels which are disclosed in numerous works (B. G. Ananiev, V. A.Batarshov, V.Ya. Vivyurskiy, P. Y. Halperin, V. P.Garkunov, Sh. I. Ganelin, I. D.Zverev, L. Ya. Zorina, I. Ya.Kuramshin, M. S. Pak, G. N. Fadeev, and others.). *Continuity* in the continuous chemical education - it is the internal *connection between the components* of the education system, the essence of which consists in the *inheritance and the preservation* of those or other elements (and characteristics) of a system *in its transition to a new qualitative state*.

In the didactic model of chemical education are distinguished: *the objectives, content, methods, forms, tools, technologies, conditions, activities of the subjects of education.* Therefore the interaction in the sphere of the contemporary continuous chemical education is built taking into account the *innovative changes* that "permeate" all of its components (the objectives, content, methods, technologies, etc.). It should be noted that the transition of the system of education to a new qualitative state associated with a *new understanding of the quality of education* (*competence, universal training actions, personal values,* etc.). An important reason for the interaction of all stages of continuous chemical education should be a Federal state standard of *the new generation* .

Building universal educational skills, and from them to the universal education act (*N.G, Milovanova, V.N. Prudaeva*), is *not possible without the subject related competences*, both in secondary and in higher school of . Interaction of secondary and higher school in the field of continuous chemical education is updated in the conditions of application of state standards of the new generation.

## CONCLUSIONS

Modern continuous chemical education is a complex integrative an object that has its own *peculiarities and tendencies of further development (update*).

The most *important features* of a modern continuous chemical education are: 1) the existence of different levels, resulting from the changes occurring in the society; 2) the complex nature of the different sides and aspects; 3) the openness of its structure and content; 4) integrative and differentiated nature of its components; 5) the integrity of the functioning of its structural components; (6) adjusting it to the requirements of the state, to the expectations of society, to the needs of the person; 7) the orientation of its competence in this based on past experience, but oriented to the future.

*The most important* trends in the development of chemical education in Russia are the following: *ensuring a new quality of education* (provision of universal educational action, competencies, values relations), *using* the *philosophy* of the value of meanings education, *integrative methodology*, the *paradigm* of innovative education, *personally-oriented* education models, *humanitarian technologies* in the educational process, the integration-context concept of chemical education.

Continuous chemical education in Russia in the conditions of the acute problems of interaction between people *in the modern multi-cultural, multi-ethnic and multi-confessional society*, the changing of the country can rely on *updated* and *success*, taking into account their *peculiarities and tendencies* of its development.

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# The teaching of chemistry in high school education in Cuba

# La enseñanza de la química en la educación preuniversitaria en Cuba

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***Abstract***

*A brief historical review of the situation of education in 1959 is made; this is the year of the triumph of Cuban revolution and its further development. Characteristics of the pre-university education in Cuba are raised, as well as some of the principal regulations of the Ministry of Education for this teaching level. Certain strengths in the teaching of science in Cuba and particularly in chemistry are expressed. This study aims to analyze the correspondence between the bibliography and the implemented study programs in pre-university education.*

*In this work various changes in this study programs and textbooks during recent years are treated, making an analysis of the situation of the bibliography currently used in the three grades of this teaching level, which serves the preparation of graduates to continue their studies at universities. The correspondence is analyzed between the objectives of the existing programs and the methodological indications using the bibliography used today.*

***Key words:*** *education, science, chemistry, textbooks, Cuba.*

***Resumen***

*Se realiza una breve reseña histórica de la situación de la educación en 1959, año en que triunfa la revolución cubana y su desarrollo posterior. Se plantean las características de la enseñanza preuniversitaria en Cuba, así como algunas de las regulaciones principales del Ministerio de Educación para este tipo de enseñanza. Se expresan algunas fortalezas en la enseñanza de las ciencias en Cuba y en particular en Química. El trabajo tiene como objetivo: analizar la correspondencia entre la bibliografía y los programas de estudio implementados en la enseñanza preuniversitaria. En el mismo se tratan los diferentes cambios de programas y textos en los últimos 20 años hasta la actualidad, haciendo un análisis de la situación de la bibliografía que se utiliza actualmente en los tres grados de esta enseñanaza y que sirve de preparación para que sus graduados continuen estudios en las universidades. Se analiza la correspondencia entre los objetivos que se proponen alcanzar en los programas vigentes y en las indicaciones metodológicas de los mismos, con la bibliografía que se utiliza en la actualidad.*

***Palabras clave:*** *educación, textos, Cuba*

## INTRODUCTION

In the teaching process the use of textbooks and other literature has a great importance. The quality of these depends on various factors which go from their writing by one or many authors to their printing. The textbook in general education reaches a significant value, usually the students according to their level of intellectual development have the text as basic material besides complementary materials.

Students are expected to read, study and workout the exercises that are proposed. This is different from higher education where the student will have a text too, but also need reference books, journals and also other types of publication in order to achieve the appropriate level.

The main objective of this paper is to analyze the current state of teaching literature in chemistry in high school education in Cuba, to see which are the positive aspects of it and which need to be improved in order to help to the betterment of teaching quality of this science. We will also show the characteristics of education in the country, regulations, strengths and weaknesses.