

Chemistry Teaching at School - Problems and Solutions

Milena Koleva,

Technical University of Gabrovo (Bulgaria)

kolevamilena@hotmail.com

Abstract

Recent years have seen the subsiding interest in sciences, including Chemistry, among young people. In general, the cause of this negative tendency has not been clearly defined. To a certain extent it may be due to the transition of our society toward a different political and social system. Another possible cause is the globalization and its impact on the educational process. Chemistry is regarded as tough science by young and adult learners. The teaching content of most school courses in chemistry add their finishing touch to the entire picture. Disproportionate informational input, too much theorization and systematic ignoring of laboratory experiments in chemistry have discouraged a great number of students who would otherwise direct their interest to this particular subject. Last but not least is the lack of whatever prospects for those who would venture in making a career in chemistry.

Bulgarian Educational System - Main Features

Schooling in Bulgaria includes training and education of students from grade one to twelve and is carried out in the following basic types of school:

- According to the way of funding – state, municipal and private schools;
- According to the level of education - *grade schools* - education is carried out in two stages (primary and elementary); *secondary schools* - high schools, profiled high schools, vocational, special schools and schools of arts;
- According to the content of training – comprehensive, vocational and special schools [1,2].

Contemporary school system analysis indicates some negative general trends as:

- Increasing the number of unschooled students and drop-outs at school age;
- Poor practical orientation of training and study contents which do not correspond to the contemporary needs of young people; low level of utilizing modern teaching methods;
- Unified approach to learning and educational processes disregarding the individual needs and gifts of students.
- Outdated system for vocational training and poor contacts with business.
- Inadequate upgrading of school facilities and equipment.

An essential feature of modern school education in Bulgaria is the fact that it is directed towards the abilities of the average student. In the existing traditional class-lessons system not enough attention is paid, and suitable forms and approaches are missing, in the work with poor performers and children of smaller learning capabilities or, on the other hand, with students with well expressed capabilities and talents in different fields of science and arts. All these processes are taking place against the background of overall international drop of interest in natural sciences at the expense of the larger interest in humanities and social sciences [3].

Teachers in natural sciences are facing some challenges:

- The educative content of the relevant subjects is difficult to learn and is frequently presented in the incomprehensible, far-fetched language of the existing textbooks.

- Lack of actual inter - subject connections in the operative textbooks in the cultural-educational area “Natural sciences” which contribute to the comprehensive acquisition of knowledge about the natural processes and phenomena on behalf of the young people;
- Work with students having humanitarian interests and skills, who are well acquainted with the modern technologies, but not educated in the smaller classes to the necessary degree which would enable them to make logical reasoning and deductions [4-6].

Education in Chemistry: Problems and Solutions

As a part of the fundamental education Chemistry learning in Bulgarian schools starts in the primary school, continues in the secondary for a period of 2 - 3 years depending on the profile of the school and finishes in the university degree where (with the exception of the specialized universities) it is taught/studied for one semester [3].

According to learners some of the most frequently faced difficulties in Chemistry studies at school are connected with:

- the content of course books which is difficult to comprehend;
- poor methods of teaching and inadequate and biased assessment of knowledge;
- outdated, inadequate or unavailable laboratory equipment which does not allow for conducting experiments and does not contribute to better comprehension of the taught subject;

These factors make up an overall understanding among school students that Chemistry is an unintelligible and sophisticated science.

Most of the interviewed secondary school Chemistry teachers share similar opinion concerning difficulties in acquisition Chemistry learning material:

- Academic style of course book content which is difficult to understand for students - Course and reference books in Chemistry abound in theorizing which encumbers the students and gives them poor motivation. This tendency is sustainable both at grade and high schools. Knowledge should be grounded on and oriented to practical experience;
- Depreciated material base and insufficient modern equipment – the lack of proper equipment is one of the most serious problems related with the study of Chemistry;
- No willingness and motivation to study;
- Lack of specialized literature written in easy to comprehend language for students who learn Chemistry;
- Not enough training courses for teachers related to the interactive methods of teaching Chemistry [7].

The process of teaching Chemistry at secondary school level is accompanied with a number of difficulties and unsettled problems. According to teachers most negative impact is due to:

- Insufficient lab equipment and base;
- The number of Chemistry classes is insufficient at school and, as the usual practice is, there is no time for lab exercises;
- Large classes with no possibility to be divided into groups during lab exercises; There are no possibilities for normally conducted lab exercises and ensuing progress check;
- Too large lesson units- students are unable to extract the most relevant information;
- Students are inadequately capable to cull textual information, read charts, diagrams, graphs and chemical equations.

Young people are poorly motivated for learning Chemistry after secondary school. Interest in learning Chemistry has been plummeting for a long time and this that is rooted in the changes in society, organization of the learning process and the method of teaching this discipline in primary and secondary schools:

- The formulated notion that Chemistry is a “difficult” and “dangerous” science - most of the students perceive Chemistry as a complicated and incomprehensible science, filled with formulae, mathematic

expressions and long inapprehensible terms. That's why few of them prefer to have close meetings with it. This opinion is expressed both by learners and secondary school teachers. The above mentioned is a direct result of the following reasons: disorderly and unclear content of course books; poor teaching - progress check and assessment were on a very low level; outdated, inadequate or unavailable laboratory equipment which does not allow for conducting experiments; large classes, impossible division into subgroups;

- No prospects for professional realization - Chemistry is deemed inapplicable in opting for profession;
- Destroyed public system of values - long years of continuous disinterestedness of the state in the matters education and culture [7]

In general, there is no particular interest in Chemistry - that is a process which has been going on for years. Chemistry is not topical because it remains underrated and the material taught is not oriented to practice. Personal attitude largely determines whether someone will continue with university studies in certain area/subject, Chemistry included. The Secondary school is the venue where this attitude is generated. How the subject is taught is of crucial importance as well as its further practical applicability.

In conclusion, the following main reasons for the present state of Chemistry learning in the country can be put forth as a summary of the points argued so far [8,9]:

- Lack of precise vision and policy concerning the volume and quality of Chemistry knowledge (theory and practice) at the different education levels (primary, secondary, vocational, higher - for chemists and higher education for non chemists) on behalf of the Ministry for education.
- Shortage of financing for the educational and scientific institutions for modernization of the material base and for use of modern equipment.
- Insufficient motivation of the learners, the teachers, firm leadership for life long learning (in particular in the field of Chemistry).
- Lack of synchrony between the specialists in information technologies who could work out interactive education and demonstration materials for visualization of difficult for demonstration "alive" of chemical processes and the teachers in Chemistry who could present the corresponding tasks and education contents with the aid of these materials.

Possible approaches for motivation of learners to study Chemistry can be found in:

- Development of conditions for self-realization of young people within Bulgaria, not outside it. Young people should be offered clearly defined prospects for self realization and professional progress [10];
- By means of additional studies, explanations in easy to understand language and practical exercises [11]; by means of comprehensible literature [12];
- New hybrid specialties are to be developed such as computer Chemistry, for example;
- Novel innovative methods of training are to be introduced relying heavily on ITC.

Policy and Practical Approaches in the Field of School Education and Motivation of Students

National policy in the field of education presented by the Ministry of Education, Youth and Science is oriented toward the following main directions:

- Achieving high quality of education;
- Ensuring equal access to education and opening up the education system.
- Development of conditions for implementation of the educational concepts "LIFELONG LEARNING" and motivation of young people for continuous education.
- Incentives young people in the development and implementation of sector policies;
- Conversion of Bulgaria In the medium term Country in which knowledge and innovation are the drivers of the economy [3].

The general national strategy is based on the following crucial documents:

- Programme for Development of Education, Science and youth policies in Bulgaria [3]

- National strategy for lifelong learning (LLL) for the period 2008 – 2013 [13].

As a step for realization of this strategy the list of major priorities for secondary education in 2012 includes also the following:

- Considerable decrease of the number of drop-outs. Both national and regional policies have focused on providing free transportation, text books and food plus developing a wider scope of extra curricula activities;
- Sustainable school network;
- Improvement of the quality of educational process, modification of syllabi and curricula and their rendition made relevant to the specific requirements of each age group during schooling;
- Improvement of professional qualification of teaching staff. About 43 thousand teachers are due to pass professional appraisal and qualification courses;
- The new Pre-school and School Education Act that has been developed by the Ministry of Education and Science passed and is due to be enforced in the school year 2012/2013.

Supporting initiatives in the field of Chemistry education at national level are:

- *Festival of Bulgarian education* - It is an event held annually and a place for public presentation of educational institutions, to search and create new contacts and partnerships with NGOs, businesses, other educational institutions, media; the festival creates area for interaction between different educational institutions, students and business;
- *National Contest in Chemistry and Environmental Protection* – it is an annual competition of high school students (grades 9-12) from all secondary schools in Bulgaria and aims at verifying the quality of education in chemistry and the environmental protection. It also allows for comparison between different training schools and is a natural place for the exchange of new approaches to training students in Chemistry and environmental protection.

Bulgarian Ministry of Education, Youth and Science developed National Educational Portal - the first serious step in creation of a large national system for e-learning of scientific subjects in Bulgarian high schools, including Chemistry. The Portal is addressed to high school and Universities teachers, lecturers and students, people interested in e-learning and education in general.

On-line lessons facilitate educational process by transferring it to the homes of potential learners allowing both students and teachers to avail of the needed information at any time and place. The very process of learning is substantially modified; the recipient is no longer trying to cram lesson facts from the teacher, but invests his/her time during classes in assimilating the underlying principles. This in turn enables individual students to create their own framework within which to prioritize and arrange all facts. Among the top advantages of the portal is its interactivity. There have been developed textbook contents for subjects included in the curricula for all grades from grade 3 to grade 12 plus the subject "Chemistry and environmental protection". They offer a large number of instruments such as glossary, periodic scheme, animations, self-assessment tests.

At regional level an interesting approach for increasing the interest towards the natural sciences and basically Chemistry has been chosen in the National Aprilov High School - Gabrovo. It is realized through an original education – theatrical performance, the so called "scientific theatre". Three such performances have been prepared and performed during the last four years. The participation of the students in the different stages is voluntary and under their own initiative, while the teachers are only coordinators.

Another way to increase the students interest and to motivate them to study Chemistry are video-lessons elaborated by Darin Madjarov (student) with the supporting collaboration and professional help of Maria Nikolova, a secondary school Chemistry teacher in Aprilov National High School (Gabrovo) having more than 20 years experience in teaching Chemistry and Environmental protection. More than 250 video – lessons (57 of them dedicated to Chemistry) have been already created and available on-line. Some of them are tests or self-training materials. Theoretical problems and chemical events are commented using examples from the real life. The terminology used to present the chemical content is scientific, but very close to the "students' language", which helps young people to understand the matter even if some basic knowledge is missing.

References

- [1] Eurybase - Bulgaria, The Information Database on Education Systems in Europe - 2005/06
- [2] National statistical Institute data (education and Lifelong Learning), <http://www.nsi.bg/otrasal.php?otr=23>
- [3] Fandykova, J. Program for Development of Education, Science and youth policies in Bulgaria (2009 – 2013 г.)
- [4] Zahariev B., Educational System – Inadequate reforms. Politics, Vol 7 (2009)
- [5] Totseva Y., N. Vitanova. National Educational Standarts or “the king’s new clothes” vs. the old national educational requirements. Strategy for policy in science and education Vol.2 (2009) pp 181-191.
- [6] Tafrova-Grigороva A., M. Kirova, E. Boiadjieva, A. Kuzmanov. State Educational Requirements: Expection and reality. Chemistry.Vol 17 (411) (2008)
- [7] Marinova-Christidi,R. Bulgaria’s higher education system and the implementation of the bologna process. Proceedings of the 2009 EMUNI Conference on Higher Education and Research Portorož, Slovenia, 25-26 September
- [8] Toshev B., 43th national conference of Bulgarian chemistry teachers.
- [9] Boyanova L., About quality of Chemistry and Envionrment Education, A Student’s personel Oriented Education
- [10] <http://projects.pixel-online.org/chemistry/index.php> LLP Project Chemistry is all around us, Transnational report.
- [11] Monova T., Methods and tools of the Teaching Cehmical Experiments: A University Subject and Its Instructional Design.Chemistry.Vol 18 (222) (2009)
- [12] Gyrova V., V. Bojilova. The portfolio of the teacher factor in the quality of education. Sofia University.
- [13] National strategy for lifelong learning (LLL) for the period 2008 – 2013, Ministry of education, youth and science.