

EDUCATION IN CHEMISTRY IN THE CONTEXT OF LIFELONG LEARNING

**Milena Koleva
Albena Tsoneva
Pencho Stoychev**

**Angel Anchev
Dragomir Vassilev
Grigor Boyadjiyski**

*Department of Chemistry and Ecology,
Technical University of Gabrovo
Gabrovo, Bulgaria*

Abstract

Promoting Life Long Learning of scientific issues is much more difficult, if compared to other subject areas (e.g. humanistic subjects, business management, language learning) as when the compulsory educational path ends up, those that are not interested in science are much more likely to abandon completely the subject. Among the scientific fields, Chemistry is recognised as one of the most problematic subject. That is because Chemistry suffers from a growing unpopularity due to a number of reasons. This paper presents in brief structure and contemporary status of Bulgarian education system with their strong aspects and weak points. An analysis of main obstacles to Lifelong Learning of Scientific Subjects, particularly in chemistry, is also presented. It is based on a survey carried out with chemistry teachers and adult learners under the project "Chemistry is all around us" (Lifelong Learning programme of the EC). Conclusions about new approaches to study Chemistry in the context of Lifelong Learning conception were drawn.

Keywords: Lifelong Learning, scientific subjects, education in chemistry.

INTRODUCTION

Promoting Life Long Learning strategies for scientific issues is much more difficult, compared to other subject areas. That is mainly caused by following factors:

- Scientific issues are often taught at school in a theory oriented approach that often discourages students interest, proposing the idea that sciences are difficult and useless in everyday life;

- Those who do not follow their studies in the scientific field through the higher education or vocational training path, usually loose completely contact with the subjects and their knowledge gap increases so rapidly that it become for them impossible to learn about it any more;

- The main channels of informal information about scientific issues, mostly media, usually provide incomplete and misleading information that affects heavily the possibility for the non-expert to really learn something reliable and scientifically consistent.

Among the scientific fields, Chemistry is recognised as one of the most problematic subject and suffers from a growing unpopularity due to the fact that Media often make improper connection between Chemistry and the ideas of pollution, health threats, manipulation of natural ingredients etc.

This paper presents the current situation in Bulgarian secondary school education with its positive and negative tendencies, and basic factors in education in chemistry in the context of Life Long Learning. It is based on a survey carried out as a part of project "Chemistry is all around us" ("Lifelong Learning" program, "Leonardo Da Vinci" subprogram of the EC) with secondary school teachers in Chemistry and adult learners in Technical University of Gabrovo.

EXPOSITION

1. Bulgarian education system – positives and negatives.

1.1. Present status of school system.
According to National Statistical Institute data [1], total number of schools in Bulgaria at the

beginning of 2009/2010 school year amounts to 2688 of which: comprehensive schools – 2121, vocational – 487, special schools - 80; state schools – 471, municipal schools – 2092, private schools – 137.

The number of students as of September 15th 2009 according to the figures provided by regional school inspectorates is 627163.

Data available for last decade show some negative tendencies in Bulgarian school:

- a persistent tendency of students' number reducing due to the demographic crisis (Fig. 1);

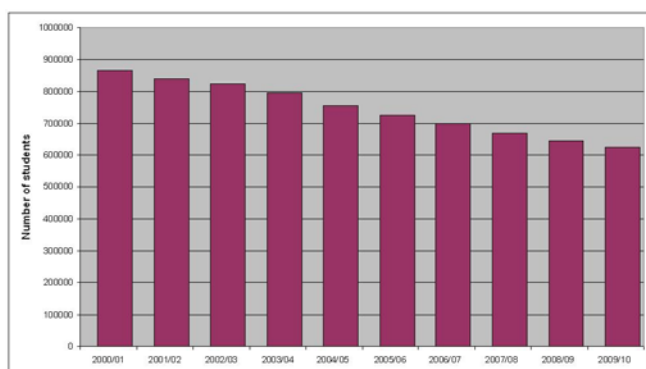


Fig. 1. Number of students in Bulgarian schools for the period 2000-2009

- The number of students which have dropped out from the school system is still considerable (fig.2.).

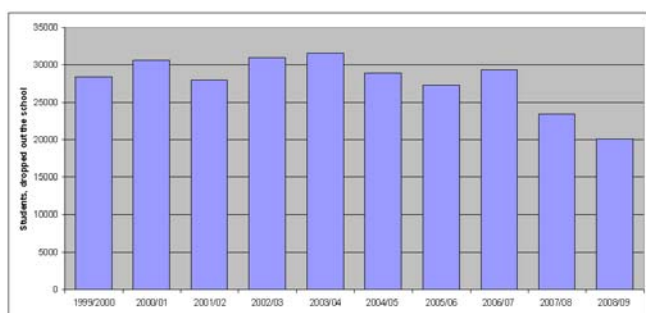


Fig. 2. Number of students, dropped out from the school system (2000-2009)

Contemporary school system analysis indicates some strong and weak points:

Strong aspects:

- Relatively well developed network of schools which guarantees comparatively decent access to education
- New model of funding based on unified expense rates for the support of one school child

- Relatively well developed system for providing access to education – free transportation; free course books and study aids for all school students from grade 1 to grade 7; e-based study contents etc.;

- Programs for upgrading of the necessary school equipment.

- System staffed by teachers with university degrees.

Weak points:

- Large disproportions in the quality of education offered by schools across the country;

- A considerable number of unschooled students and drop-outs at school age;

- Insufficient financing;

- Tight centralization and lack of autonomy for educational institutions;

- 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.

- Underrated educational role of Bulgarian school.

- Underdeveloped forms of life-long learning.

- Inadequate upgrading of school facilities and equipment [2].

1.2. Present status of tertiary school system

At present the tertiary education system in Bulgaria comprises 51 institutes of higher learning (37 state run and 14 private) including 42 universities and specialized institutes, and 9 individual colleges. According to the release of the National Statistical Institute for 2009/10 academic year total number of undergraduate and postgraduate students is 283 236. Last years the number of student in part-time and distant university education increases (fig.3) - these forms of education become more and more attractive because of the possibility to save the work during the training [1,3].

The current survey of the academic system status indicates the following:

Strong aspects

- Introduction and adoption of three degrees of academic training: Bachelor, Master's and Ph.D (in accord with the Bologna process);
- Development of Classifier for the areas of tertiary education and professional trends;
- Introduction of joint program learning with leading EU universities concluding with certified graduation diplomas issued by both partner universities;
- Instituting of the National Agency for Evaluation and Accreditation as independent agency at the Council of Ministers;

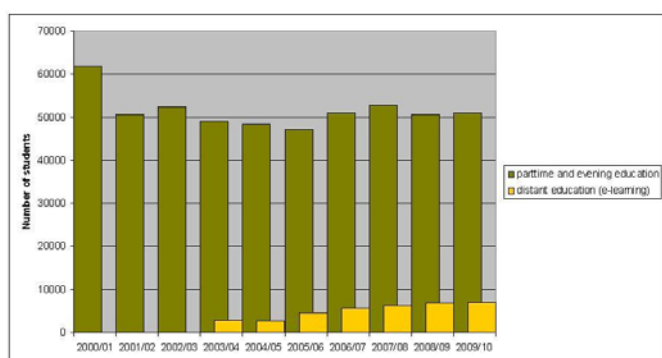


Fig. 3. Number of student in part-time and distant tertiary education

Weak aspects:

- Lack of holistic vision (strategy) for development of tertiary education;
- Dysfunctional Act for crediting undergraduates and postgraduates;
- Degree courses and academic programs are not accorded with the needs of the labour market; student admission to universities is not bound to the real figures demanded by the national economy.
- Outdated regulation;
- Aging academic staff, poor motivation and underrated social status of academics; lack of interest in following academic career;
- No diversified sources of tertiary education funding; ineffective system for financing and allocation of the government grant;
- No unified performance rating system for higher education schools;
- Deficiency in research activity during training of students, lack of innovations and

inadequate level of cohesion between higher education institutes and science;

- There are real problems with the issuance of the European diploma/certificate supplement and the formal application of the European Credit Transfer System (ECTS);

2. Main obstacles to Lifelong Learning of Scientific Subjects

2.1. In school education

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. The 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 [4-7].

2.2. In university education

Over the last few years Bulgarian institutes of higher learning have been facing the ever increasing competition on behalf of foreign universities. The National Agency for Assessment and Accreditation has not assisted much in providing for the real modernization and reforming of tertiary education institutions and, similarly, its contribution in creating a

solid public trust in higher education has been marginal. Lack of clear rules for binding of the assessment marks with the system for encouragement or sanction of tertiary schools does not stimulate improvement of quality. Accreditations granted by foreign agencies for accreditation are not recognized [8-11].

There exist real problems connected with the issue of European diploma appendix and the formal application of the European Credit Transfer System (ECTS). The system which presently is in force is not harmonized with contemporary European (ECTS), yet. They account the equality between the work load and the outcomes of education. That is why a lot of students have difficulties with their (ECTS) credits acknowledgement (recognition) under the terms and conditions of mobility. There are no existing prerequisites for the universities to be turned into research centres.

In the light of the above, the challenges confronting higher education in our country generate additional gravity. Particularly the case in point is:

- Frequent criticism on behalf of employers concerning the quality and adequacy of preparation of higher schools graduates.
- Shortage of financial resources for the provision of modern educational process conducted by highly qualified teachers.
- Demographic crisis in the society, accompanied by diminishing the number of potential students amongst young people and increase in the number of the people in more advanced age who need to acquire new knowledge and skills.
- Change in the profile of the students as more and more of them opt for learning combined with some form of work [2,8].

2.3. In the education of adults

Learning in situ (at work place) is implemented through various forms in Bulgarian companies:

- "learning by doing" and transfer of skilled personnel experience which is regarded as specially effective means for introducing of newly appointed staff into their scope of professional obligations;
- Informal education through lectures, seminars and courses organized by either the

company or other external organizations aiming at enhancement of qualification of personnel and their adapting to introduced innovations;

- Independent individual education;
- Participation in the formal educational system.

Informal education and training is the most important of the various forms of learning at work place. Participation of Bulgarian employees in informal education is a result of their personal initiative. Higher education level is preferred for participation in the formal educational system on behalf of employees, therefore institutes of higher learning should be treated with special attention and developed into potential centres for lifelong learning. University strategies for lifelong learning should be developed in accordance with three basic principles:

- Flexibility at the entry and exit of educational institutions as well as during the very process of education (for example, accreditation of skills acquired at the work place);
- Orientation of the process of learning toward student needs and formation of certain competences;
- Building up networks and partnerships with other institutions of higher learning and most of all with concrete companies (businesses); establishing of various forms of collaboration between enterprises and educational institutions such as internships, recruitment of most promising performers, organizing modular courses for employees etc.

A survey conducted among adult trainees indicates that there are two main reasons for giving up the option of university studies after secondary school graduation:

- Financial - no financial possibility to pay for university tuition; this urges young people to start work and, consequently limits their options for formal education. In that case the only possibility for training is in the form of informal and individual learning;
- Lack of appropriate orientation concerning the preferred university or degree course. This leads to inadequate preparation, hence the poor performance at admission exams and the inevitable failure to enrol in the courses of study at the selected university;

- Other – includes the obligation to do the military service.

3. Basic factors in education in chemistry

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.

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.

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 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.

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.

CONCLUSION

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 [12,13]:

1. Lack of precise vision and policy concerning the volume and quality of chemistry knowledge (theory and practice) at

2. 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 after secondary school graduation 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;

- By means of additional studies, explanations in easy to understand language and practical exercises [14,15]; by means of comprehensible literature [16];

- 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.

Within the context described above and Lifelong Learning Strategy the following common needs can be identified:

- The need to identify and implement a comprehensive educational strategy to promote Lifelong Learning of scientific subjects and of Chemistry in particular;

- The need to identify and implement an educational strategy to combat prejudice, false beliefs and misleading information that affect the continuous learning of Chemistry;

- The need of offering to the general public, innovative instruments and learning strategies that should allow them to improve and update their scientific knowledge as far as chemistry is concerned.

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