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Chemistry Teachers' Training: Bulgarian Reality

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Abstract

The state of the art of chemistry teachers' training in Bulgaria is discussed in this paper. A brief overview of the professional development of science teachers is proposed. The organization of the initial science teacher training at universities is described as well as the continuous qualification of teachers. Some problems and priorities of the teacher training policy are outlined and commented. The activities and their impact in the frame of the Chemistry is all around Network project are reported. The surveys on interests and professional development of Bulgarian teachers and project outcomes indicate that there is need for additional training for implementation of student-centered methodology in chemistry teaching. Some recommendations on national policy for teacher initial and continuous training are proposed.

1 Teacher Training: policy and realities

Bulgarian state policy related to teacher training is an integral part of the national educational policy. The coordination of the activities related to the planning, organization of education and improvement of teachers' qualification is performed by the Qualification and Career Development Directorate at the Ministry of Education and Science. It is responsible for the actions referring to the development and implementation of the state policy regarding the qualification and career development of the teaching staff. The educational and qualification activities are performed by institutions or specialized units accredited by the National Evaluation and Accreditation Agency [1].

The issues and challenges of teacher training and qualification are a special point of discussion among Bulgarian institutions within the context of the continuous (over 20 years) reform of Bulgarian education. As a result of this reform and mainly of its part related to the school system financing (started in 2007) some aspects of the current policy of teachers' qualification seem to be not effective.

The first one concerns the *continuous qualification of teachers*. The results of the TALIS international survey conducted by the Organization of Economic Cooperation and Development /OECD/ show that Bulgaria, along with Slovakia, Poland Spain and Italy is among the countries with the highest percentage of teachers who are Master's degree holders. Pedagogical training that is offered at university level is obviously insufficient for their successful professional realization. The rapid development of science, technology and innovations demand adequate qualification of teachers to meet the ever expanding range of students' needs [2]. A study conducted in March and April 2013 by the University of World and Home Economy among 228 school principals and 998 teachers indicate that half of the teachers do not have qualification level and every second teacher possesses only minimum of required qualification and is not involved in a follow-up in-service training. The five qualification levels are not compulsory and are covered after a certain amount of work experience is reached [3].



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The low and inadequate *material incentives for professional upgrading* are another problem related to the teachers' motivation: the funds allocated for that purpose amount to barely 0,8% of the entire salary fund. According to the survey mentioned above 71% of all teachers are dissatisfied with their payment. The most satisfied is the group of young teachers of age below 25 (their percentage being 55%), however, they are the smallest group in the teachers' guild. Those of age 56+ who constitute the largest segment of the guild are the most dissatisfied [4].

The next serious problem of Bulgarian state policy *relates to the young teachers*. A survey conducted by the European Commission reveals that only four European countries possess specialized programmes for introduction of newly appointed teachers. Bulgaria is among those which do not have such programmes. Young teachers need the continuous support of senior teachers for at least one year which will help them to develop some practical skills in teaching and make effective connection with both students and parents. A hindering condition to the prospect of quick professional growth appears to be the clause which requires working experience of at least ten years as a prerequisite for acquiring the status of "senior teacher" [2].

A major problem in the teachers' qualification policy appears to be the *lack of present day analysis* on the specific types of in-service courses needed by teachers. The usual practice is to offer a list of courses which, as is often the case, are selected by the school principal [4].

2 Training of Science Teachers

Officially training of science teachers, including Chemistry teachers, started at the 30s of the last century. Within a period of almost 20 years the only state institution authorized in legal training of Chemistry teachers in Bulgaria was Sofia state university. Later, in 60-70s, in-service teacher training became a part of the chemical education in other universities such as Plovdiv University, Shumen University and etc. Nowadays chemistry teachers in Bulgaria are trained in four state universities: Sofia University, Plovdiv University, Shumen University and South-west University of Blagoevgrad.

2.1 Initial Teacher Training

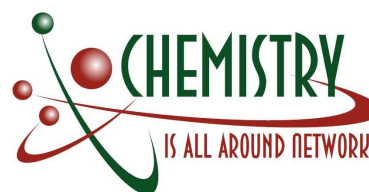
Bulgarian universities offer Initial Teacher Training in Chemistry in Bachelor and Master degree programmes. *Bachelor degree courses* emphasize on knowledge of subject matter, pedagogical preparation and practical school experience. The future teachers are enrolled in combined double undergraduate programmes: chemistry and physics, chemistry and informatics, chemistry and biology. Universities of Sofia and Shumen offer simultaneous degree for teachers only in Chemistry. Most of the courses are face to face and full-time, but some of them use blended learning, e-learning and face-to-face. Educational content for Chemistry teachers include general subjects and core subjects through which prospective teachers acquire knowledge in contemporary chemistry education and skills to work in real school settings. Bachelor degree programmes which train teachers in two subject areas include core and general studies plus training in pedagogy, psychology, theory, methodology and application of both subjects. Training in Bachelor degree ends up with state exams in both major degrees e.g. chemistry and physics; chemistry and informatics or chemistry and biology.

Master's degree courses in general are intended for in-service teachers; however training also is available for candidates who are not involved in active teaching. Master degree courses in Teacher of Chemistry admit teachers with bachelor's degree in chemistry or other courses which include chemistry-based core subjects such as Chemistry, Chemical engineering, Agrarian science, Pharmacology, Dental medicine etc. Students graduate with state practical exam and Master thesis on chemistry education. Successful graduates are awarded master degree "Teacher of chemistry". As the Master's degree courses aim at expanding knowledge and skills of in-service teachers and



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familiarizing them with the latest trends in chemistry teaching also, they include specific subjects such as Chemistry for school, Chemistry and society, History and philosophy of chemistry, School documentation and standards for chemistry education, Rhetoric, Chemistry concepts and theories, School assessment etc.

Pre-service teachers' training is focused on modern educational strategies and approaches, the accent being on research and problem-oriented interactive methods. Minimum amount of subjects required for the acquisition of "teacher" qualification is regulated by law. Chemistry teachers are to cover large number of Chemical subjects but also subjects of pedagogy, pedagogical psychology, chemistry training didactics, audio-visual and information technology in teaching chemistry plus internship. They also could opt on additional courses such as Achievement chemistry tests, Pedagogical reaserch, Chemical tasks etc. Students get familiar with the opportunities offered by the use of IT and communication technologies in chemistry education, they also learn how to develop personalized software and employ it in their practice.

During their studies some students are actively involved in research projects both in the field of chemistry science and education. Students in Master's degree courses for teachers must conduct their own research in teaching chemistry while preparing their thesis.

2.2 In-service Teacher Training

Vocational training upgrade is a follow-up of continuous learning which includes various forms of postgraduate training and aims at increasing professional efficiency of teachers, chemistry teachers included.

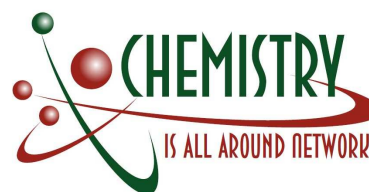
All methods, conditions and funding of in-service teacher training are regulated by law. In-service training of teachers is affected primarily in institutions of higher learning or in their specialized departments. Three Bulgarian universities: Sofia University, Plovdiv University and Thracian University of Stara Zagora conduct in-service teacher training in various trends and on annual basis.

In addition to specialized courses carried out in university departments, teachers may acquire professional qualification levels from five to one on the grounds of studied courses and held exams; levels one and two are acquired following a defense of thesis papers.

Access to in-service training depends on school head administrations. The delegated budgets of schools include allocations for funding teachers training however these amounts are very limited and therefore used to support part of teaching staff while they attend qualification courses. Acquisition of professional qualification levels is possible with the consent of school principal and the positive reference on behalf of regional inspectorates of education.

During the last few years short-term courses of 8 to 16 hours for chemistry teachers were carried out on topics such as "Information technologies in teaching chemistry", "Interactive methods in teaching chemistry", "Educational standards, curricula and targets in chemistry education", "Active learning in natural sciences – physical, chemical and biological experiments in education", "Assessment of teaching quality in science training", "Chemical experiments", "Design and development of achievement tests", "Strategies for and approaches to integrated training in the subject", "Man and Nature", "Reflection and natural science learning" etc.

In addition to these forms of qualification there are various other sources such as special programmes, projects, websites and private organizations which offer opportunities for improving teaching competence in natural sciences. Since August 2013 Ministry of Education and Science in collaboration with other state institutions has launched the project "Qualification of Pedagogical Experts", co-funded by the European Social Fund of the European Union [5]. The project objective is to train over 42000 teachers by the end of 2014, which is 80% of the total number of teachers, so as



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to improve their qualification. The focus is on pedagogical experts, who are appointed to positions that are novel for the educational system and also teachers who rejoin school staff after continual leave (over two years) or after termination of teaching experience in the related subject for more than two years.

Among web sites and portals providing opportunities for enhancing the teaching competence it is worth to mention National Educational Portal and Teachers Innovators Network (Teacher.bg) - the Teacher.bg virtual school offers free on-line training in relation to the state-of-the-art technologies, methods and programmes referring to the introduction of electronic teaching content in the classroom to all teachers registered in the Network [1].

3 Training of Chemistry Teachers: the teachers' view point

3.1 Studies of Chemistry Teachers' Views

A complete study of the pre-service and in-service chemistry teachers' views and preferences has not been conducted in Bulgaria. However, an opinion poll conducted among them outlines several aspects:

- Philosophical and pedagogical views of the constructive learning classroom environment [6-10] – results indicate the need of further qualification of in-service teachers which is to be oriented at the application of constructivist approaches and methods such as problem-based approach, team work, work in small groups, collaborative and joint learning in a classroom. This in turn necessitates the updating of university curricula for teacher training;
- Possibilities to enhance scientific literacy of students through learning chemistry [11] – it is noted that chemistry subject content in Bulgarian schools is oriented more to theoretical rather than practical knowledge. A survey show that science teachers are interested in a variety of modern scientific topics such as environmental chemistry, new materials, nanotechnologies, food and health, green chemistry etc. Teachers argue that the science curriculum should be improved in a way to ensure more real life knowledge, experimental work and key competences, and thus to enhance greater scientific literacy of students.
- Application of ICTs in school science education – studies indicate a serious need of upgrading teachers' competences in this particular field [12, 13]. Chemistry teachers are motivated and determined to upgrade their ICT competency. Therefore it is very important to evaluate the current level of teachers' competence in application of ICT so as to define the needs for improving their qualification. A system for evaluating chemistry teachers' competence based on the guidelines for ICT competence assessment standards of UNESCO has been developed by the Research laboratory on chemistry education and history and philosophy of chemistry at the Sofia University. This evaluating system can also be successfully applied to the training of university students, future teachers in Chemistry.

3.2 The Impact of the Project on Teacher Training

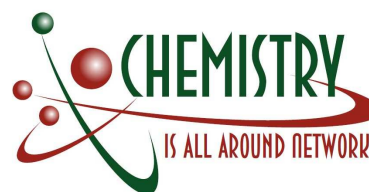
In the context of the current picture described above training issues of chemistry teachers focused a great part of Chemistry Network Project activities during the second project year. They aimed:

- To clarify the problems related to chemistry teachers training through the viewpoint both of teachers and experts involved in teacher training activities, offering forum for discussions and exchange of opinion not only at national but at international level also;



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- To discuss possible ways for improving the efficiency of teachers' training system in general and Chemistry teacher training in particular, by considering teachers' opinion.

The first step was to contribute to the collection of publication on teacher training uploading on project portal - number of Bulgarian publications on teachers' training issues has been reviewed and the most important of them have been uploaded on the Portal to be assessable by all project partners.

Review of the papers allowed Bulgarian chemistry teachers and experts involved in the project to get familiar with the other partners' experience in teacher training and to discuss them during the National workshop on Training issues of Chemistry teachers. The young teachers' professional support (mentoring) is one of the most serious problems of Bulgarian training system. Partners' policy for young teachers was highly evaluated as a good practice. Teachers' and experts' critical point of view however was addressed to Bulgarian educational policy concerning the unsolved problems of chemistry teachers' qualification in the context of ICT application at school, the lack of modern normative regulations for teachers' training, the insufficient financial aid for teachers which has to provide for the qualification improvement etc. The participants agreed that the role of the teachers in the modern process of chemistry education for increasing the interest and motivation of students towards the subject is crucial. In order to perform it, however, teachers must constantly develop their pedagogic and communicative skills, particularly those ones related to the use of modern technologies for educational purposes. This raises problems concerning qualification and expanding the competence of teachers, such as:

- Developing a modern conception and updating the normative basis regulating the activities for teachers' qualification by considering and using teachers' opinion
- Binding these activities with proper financial incentives, which will motivate teachers to improve their pedagogical skills.
- Developing effective qualification courses for distance or online training which will enhance and motivate teachers to expand their competence.

These problems were presented to the other project partners during the Transnational virtual meeting on Teacher Training. Bulgarian chemistry teachers and experts had the opportunity also to compare different systems of teachers' training and to find out some similar problems in the other European countries.

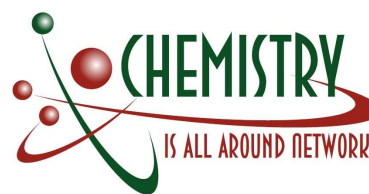
International Conference on Training Issues of Chemistry Teachers held in Gabrovo was logical continue of the project activities on Teacher Training. More than 60 participants from 11 European countries attended the Conference, among them representatives of universities, schools, educational and public authorities. Main thematic topics of the conference such as Policy for teacher professional development, Good practices in teacher training, Teachers' ICT competency, Implementation of ICT in teacher training allowed to continue discussions on training issues of chemistry teachers already at international level. The participants came to the common conclusions that despite differences in educational systems there are common problems also. Although some practice in teachers training established in the different countries, there is a common need of clear policy and regular activity in science teachers' training to guarantee their permanent professional development and, thus, the high quality of the educational process.

Presented by young Bulgarian teachers and experts good practice in use of ICTs applications, incorporation of science in chemistry by amusing experiments and "scientific toys", and development of different forms of collective work as school scientific projects, club activity etc., created a bridge to the final Project's thematic area dedicated to Successful experiences and Good Practices for teaching Chemistry. They also correlate with the project aim to develop collaboration between university professors and researchers and secondary school teachers so as to identify a common approach and



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a strategy to allow the better exploitation also at secondary school level of the most recent findings in the field of chemistry science and chemistry teaching.

4 Conclusions

The introduction of new technologies and interactive methods into school education is prerequisite to high quality learner-centered teaching in chemistry. Chemistry teachers play a key role in this process and in development of skills that will help their students in acquisition of knowledge. The surveys on interests and professional development of Bulgarian teachers and project outcomes indicate that there is need for additional training for implementation of student-centered methodology in chemistry teaching [7]. Teachers do not feel prepared enough to manage the teaching process along with their students. However, teachers are willing to participate in all possible forms for mastering and applying new teaching approaches and methods, as well as to work together in future projects.

Viable national policies for teacher initial and continuous training, recruitment, retention, status and working conditions should be addressed to the following:

- the state should invest more in the natural sciences education, including chemistry education, by supporting teachers' professional development, providing the necessary materials, equipment and technologies;
- schools must be supported in attracting qualified teachers and universities must be assisted to attract the best students for science teacher profession; the recruiting of new teachers must go hand in hand with improving their qualification;
- the state educational requirements, programmes of study and curriculum should be reviewed and improved;
- the legislative framework defining the organization and conduction of training and the evaluation of the qualification and skills of the teachers should be updated [7].

Possible solution to the problems of professional qualification of teachers in Bulgaria would be the endorsement of a new Secondary Education Act. The Bill foresees the introduction of the so called "quick run" that will motivate young teachers for quick professional growth. The Bill also foresees statutory individual professional qualification of teachers since in the current provisions of the existing law this is not binding.

The Chemistry is all around Network Project could effectively contribute to enhance the chemistry teachers' training and qualification by:

- involvement of new associated schools and institutions responsible for teachers' training in the Project activities, helping policymakers to develop a clear national conception and update the normative basis for science teachers' qualification by considering teachers' opinion.
- supporting science (chemistry) teachers in all aspects of their work by providing them with methodological materials, interactive teaching resources, information about good practices in science (chemistry) teaching available not only at national level, but provided by the other Project partners also;
- improving the interaction between chemistry teachers and scientific experts.

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