



518300-LLP-2011-IT-COMENIUS-CNW

International Conference on Training issues of Chemistry Teachers

First Conference on the thematic area

Teacher Training



Gabrovo (Bulgaria)

26 June 2013



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518300-LLP-2011-IT-COMENIUS-CNW

Introduction

The International Conference on Training Issues of Chemistry Teachers took place in Gabrovo on 26 June 2013. The conference is an essential part of activities related to 518300-LLP-2011-IT-COMENIUS-CNW Chemistry Is All Around Network project, under the Community Lifelong Learning Programme, Comenius Sub Programme, Networks Action. Organizer of the conference was Technical University of Gabrovo in close collaboration with Research Laboratory on Chemistry Education and History and Philosophy of Chemistry – Faculty of chemistry and pharmacy, Sofia University, and Aprilov National High School – Gabrovo which are associated partners of the University in the Project.

A primary goal of the conference was to turn it into a wide forum of discussing issues as: the methods of teaching the subject at school; the difficulties of chemistry teachers to keep update to the continuous progresses of the research; competences of chemistry teachers in using ICT as a mean to communicate with students and enhance their interest towards Chemistry lessons; opportunities and space within the institutional programmes for experimenting different approaches and methods for teaching and learning Chemistry; development of active partnership between university chemistry professors and researchers and secondary school science teachers so as to identify a common approach and 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.

To reach this goal following main topics of the conference were defined:

- Policy for teacher professional development
- Modern pedagogical approaches for student-centered teaching
- Curriculum and assessment of advanced skills development
- Teachers' ICT competency
- Implementation of ICT in teacher training
- Good practices in teacher training.

Conference Organisation



To promote the Conference among Bulgarian and foreign chemistry teachers, experts involved in Chemistry education and all people interested in Teacher Training issues, Conference website in Bulgarian and English was created (<http://tict.tugab.bg>). The website offers useful information about Conference topics, program, authors' profile. Presently on the website are available all presented paper and videos of some presentations also.

The Conference was hosted by Aprilov National High School – Gabrovo. It dealt with 3 thematic areas, organized into 4 sessions:

- Training of Chemistry Teachers – European Realities;
- Teachers competences: modern student oriented pedagogical approaches;
- Methodology to Teach Specific Chemistry Topics



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518300-LLP-2011-IT-COMENIUS-CNW

Although the conference organizers offered authors attending the Conference to present their papers on a poster, there were no posters.

The participants have been offered a visit of the National Museum of Education – the Museum is the only one of its kind and represents the development of Bulgarian education from 19th century up to the present.

The conference programme is available both on the conference web site (<http://tict.tugab.bg/index.php>) and as annex to this document.

Conference Participants

Almost 62 participants from 11 European countries attended the Conference. Among them were representatives of Universities, Schools, educational and public authorities. The complete list of participants is available as an annex to this document.

Conference Contents

During the conference, 23 papers organised in the mentioned above thematic areas have been presented.

All presented papers have been published in a book (Conference proceedings) by the Bulgarian publisher Kredo 3M. They are also available online on the Conference website (<http://www.pixel-online.net/science/conferenceproceedings.php>). The book is available as annex to this document.

Papers with important scientific content will be published in “Chemistry: Bulgarian journal of science education”, published by the Ministry of Education, Youth and Science (ISSN 0861-9255) <http://khimiya.org/>. The articles appearing in this journal are indexed and abstracted in CHEMICAL ABSTRACTS and SCOPUS.

Eleven papers have been presented under the thematic area “Training of Chemistry Teachers – European Realities”. Some of them are briefly described below.

Marie Walsh, from Limerick Institute of Technology (Ireland), presented a paper “*Teacher Training in Science: Ireland*”. According to the author teachers are seen as key actors in motivating students to appreciate and study Science Technology Engineering and Mathematics (STEM) subjects, including Chemistry subjects. Teacher training in Science Education is an important factor in the development of motivated and motivational educators. Science education at second level in Ireland is in a state of change: A proposed revamp of the junior secondary school curriculum, in which Chemistry is taught as part of an integrated Science subject, is underway. A proposed new curriculum for senior second level Chemistry, with a more emphatic requirement for practical work, is currently in the post-consultation phase. A new Chief Examiner for Chemistry at secondary level has recently been appointed. All this reform comes at a time when uptake of Chemistry as a subject for the terminal examination at second level in Ireland, the Leaving Certificate, has seen a slight increase to over fourteen per cent. However, this turnaround could be difficult to maintain due to a number of factors, including the fiscal situation and its effect on school budgets for more expensive practical subjects, as well as allocation of subjects within timetabling constraints and choice by students of the science and technology subjects. Teachers and school facilities have a central role to play in attracting students to study Chemistry. Just as the curricula are in the midst of a state of reform, likewise the system and requirements for initial teacher education is undergoing a number of changes. In this aspect the paper presents a review of the current status in Ireland for training teachers of Science and Chemistry. It also reviews the opportunities and supports for Continuous Professional Development.

Julien Keutgen, from Inforef (Belgium) presented a paper entitled “*Teachers’ Training in the Fédération Wallonie Bruxelles*” (authors Myriam de Kesel, Bernard Tinant, Nathalie Matthys, Divna Brajkovic, Jean-



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518300-LLP-2011-IT-COMENIUS-CNW

Luc Pieczynski). The paper presents the approaches to teachers' initial training in the Fédération Wallonie-Bruxelles. They mention that "Academic knowledge" and "professional practice" are mixed in variable proportions: the initial training of primary school teachers (for pupils between 6 and 12 years old) and Agrégations de l'Enseignement Secondaire Inférieur AESI (12 to 15) are organised in Hautes Écoles (HE) in a three-year cycle and lead to a bachelor's degree with a professional orientation; the initial training (AESS) of agrégés in upper secondary school (15 to 18) is organised in universities in a five-year cycle and leads to an academic master with a didactic orientation, or in a 6 year specialised academic master with extra training. A project of structural reform of teachers' initial training is currently under consideration to change the composition of the upper education landscape. The project intends to extend the training cycle in hautes écoles and to build new frames of reference of skills. This approach has to redefine the profession of teacher in its multiple missions: pedagogic, didactic and as a social and cultural partner.

Zdeněk Hrdlička, from the Institute of Chemical Technology, Prague (Czech Republic) presented a paper entitled "**Teacher's Training in the Czech Republic**". The paper deals with the current situation on teachers' training in the Czech Republic. Training of teachers once they have graduated from universities is not as spread activity as desirable. Sure some workshops and training lessons take place but in overall view, the general interest is low and there is no required standard of teachers' life-long learning. The most important idea is that teachers can teach these "old" topics in modern way. This is the main aim of teacher's training: How to train professors to teach in more attractive way, how to impress the attention of students. The five articles reviewed in the paper can give us the illustrative example trying to put boring science into more interesting way.

Dionysios Koulougliotis, from the Technological Educational Institute (TEI) of Ionian Islands (Greece), presented a paper entitled "**Training of Chemistry Teachers: International Experience and the Greek Case**" (authors: Katerina Salta, Dionysios Koulougliotis). In the first part of the work, the authors make an attempt to present the main characteristics and factors that influence the quality and effectiveness of a chemistry teacher training program by reviewing selective international publications. In the second part, they specifically examine certain aspects of the same subject as applied in the Greek reality, by reviewing relevant publications. The international experience shows that a teacher's professional development programme that is coherent with school practice and teachers' goals, that has sufficient duration, that focuses on content knowledge and that involves active learning, is more likely to produce enhanced knowledge and skills. More empirical research work is required in order to establish predictors which lead to teachers' empowerment via the application of a training programme. In Greece, secondary school science teachers have in-depth academic training in the content subject but a fragmentary and non-systematic pre-service educational preparation for entering the teaching profession. Despite the increase of in-service training programs, the teachers' needs remained largely unsatisfied. Researchers have pointed out the need for teachers to master both pedagogical and content knowledge and be aware of their in-between links, in order to effectively implement the chosen teaching strategy. In addition, research has pointed out that primary school teachers often hold several misconceptions in regard with chemical phenomena and effort is made to design and implement targeted in-service training programmes for overcoming this problem. The establishment of the interuniversity Masters programme entitled "Chemical Education and New Educational Technologies" aims at providing scientific and educational training to Greek chemistry teachers; it constitutes a successful example which needs to find more followers and state support.

Laura Ricco, from the University of Genoa (Italy) presented a paper entitled "**Training of Science Teachers in Italy**" (authors: Maria Maddalena Carnasciali, Laura Ricco, Aldo Borsese, Irene Parrachino). The paper describes the training that science teachers receive in Italy and underlines the lack of important skills such as pedagogical and educational skills. Few guidelines to teach science at school are given on the base of the experience of researchers and expert in teachers' training. In particular, the problem of communication between teachers and students is addressed and suggestions are given in order to make it effective, thus minimizing the difference between what the teacher means and what the student perceives. Few words of cautions are also given as regards to the laboratorial approach: it is a very useful teaching tool to develop the cognitive autonomy of pupils, but it has to be used in the correct way.





518300-LLP-2011-IT-COMENIUS-CNW

Monika Smaga, from the **University of Computer Sciences and Skills, Lodz (Poland)** presented a paper entitled “**Chemistry Education in Polish Schools**” (author: Aleksandra Smejda-Krzewicka). In the paper the chemistry education in Polish schools (including lower secondary school, upper secondary school and higher education) was described. The Ordinance of the Minister of Science and Higher Education from 17 January 2012, which was also signed by the Minister of Education [2] is currently in force in Poland. In this regulation standards of training to work as a teacher have been determined. According to them one should pay attention to: the effects of education (learning outcomes) on the expertise and methodology, pedagogy and psychology, preparation for the application of technology information and foreign language proficiency, the duration of studies and postgraduate studies and the dimension and organization of training programmes for teachers. Universities provide the education to prepare for the teaching profession in college and postgraduate studies in the relevant training modules. In the chemistry education it is extremely important that the teacher could present the student with practical aspects of chemistry, while meeting the educational and tutorial purposes. The awakening of students' natural curiosity for the world is not without significance, too. Therefore the purpose of proper training and education in schools is to transfer knowledge in a clear and understandable manner, to present the importance of chemical knowledge in everyday life, to shape the attitudes of research and logical thinking and drawing conclusions from observations. Properly carried out monitoring and assessment of performance has a significant impact on the course and the final effects of the learning process. It is the continuous professional development of chemistry teachers which guarantees the highest quality of students' learning. This is possible thanks to the numerous courses, including language courses.

Filomena Barreiro, from **Polytechnic Institute of Bragança (Portugal)**, presented “**An overview of teacher training in Portugal**” (authors: Olga Ferreira, A. Silva, M. Filomena Barreiro). The paper presents an overview of teacher's training in Portugal concerning initial teacher training (ITE), specialized training and in-service teacher training, as considered by the Portuguese legislation. A special emphasis was given to training in information and communication technologies (ICT) and to teaching of experimental sciences for primary school. Moreover, chemistry teacher's training was contextualized in this scenario. Presently ITE corresponds to level 7 of the European Qualifications Framework (master degree). It is a career-long professional development, where research-based and in context practice are important features. Nevertheless the implicit valorisation of the teaching career arising from Bologna process implementation, a master degree is needed for all teaching levels; a lack of motivation to pursue teaching careers is generally noticed in Portugal as a consequence of the actual context of a surplus and unemployment among the new teachers. Following ITE, in-service training allows teachers to complement, deepen and update their knowledge and professional competences. This is an important measure for in-service long date teachers' and particularly relevant for the ones that, following teacher career reorganization, had to readapt to new curricula and even new teaching subjects.

Juraj Dúbrava, from **TRANSFER Slovensko, s.r.o. (Slovakia)**, presented a paper entitled “**Chemistry Teacher Training in Slovakia**” (authors: Katarína Javorová, Beáta Brestenská, Milica Križanová). Several nation wide projects focusing on teacher education are presented in the paper. The Digital Technologies (DT) have become an integral part of the didactic process of all education levels. Their integration into education is in Slovakia seen in the terms of the use of technologies. Many times there is a lot of incorrect and superficial understanding in the society of what Digital Technologies are and what role do they play in the cognitive and learning processes. Teachers are required to use technologies in the education process during their lessons. There is an ongoing training of the teachers organized by the school management. Here they learn to work with different technologies that school already provides or would like to provide. Unfortunately, majority of the trainings aims merely at the technology's technical aspects and not its didactic use. The modernization of the education system counts with well prepared teachers who are trained in modern technologies, therefore the need for lifelong teacher learning at all types of schools arises. The process of transition from the traditional to modern school was launched in Slovakia by the national project Infovek Slovensko (Infoage Slovakia). The program was employed during the years 1999-2004. It aimed to prepare the young generation in Slovakia for life in the information society of the 21st century. Following this step several nation wide projects focusing on teacher education were implemented: National projects Modernization of the education system at elementary schools and Modernization of the education system at high schools.. Their main objectives were to achieve changes in the teaching forms and methods at schools and to prepare elementary and high school teachers.





518300-LLP-2011-IT-COMENIUS-CNW

The aim group consisted of elementary and high school chemistry teachers who participated in the national projects.

Cristina Gaitan, from **Spanish Confederation of Education Centres (Spain)**, presented a paper entitled **“Science Secondary Teachers’ Training Perspectives in Spain”** (author: Antonio Jesús Torres Gil). The paper offers a brief review of those abilities Science Secondary Teachers working in Spain need to acquire as well as a description of the current system of teachers' initial training programmes along with some evaluative comments on this system after its first year of implementation. After analysing of teachers’ initial training, a review on lifelong training by means of educational research is provided which focuses on a) main difficulties found by teachers and b) teachers’ needs for training on ICTs in order to use them in the classroom properly and not only as part of their initial training but also in daily practice.

Murat Demirbaş, from **Kırıkkale University Education Faculty, Turkey**, presented a paper entitled **“Chemistry Teacher’s in-Service Training Needs in Turkey”** (authors: Murat Demirbaş, Mustafa Bayrakci, Mehmet Polat Kalak). The authors mention that it's important for teachers to get education and training before and in service. The form of the education to be given should be chosen according to needs and problems faced. In this regard, researches about chemistry teachers' education in service in Turkey have been analyzed. The results gathered tell us that teachers need in-service training about classroom management, teaching methods and techniques, knowledge of general teaching field, evaluation of learning products, recognition of curriculum and using coursebooks essentially.

Milena Koleva, from the **Technical University of Gabrovo (Bulgaria)**, presented a paper **“Innovative Teaching for Creative Learning: Teacher Training”** (authors: Milena Koleva, Adriana Tafrova Grigorova, Milena Kirova). The paper views the issues of the teachers' qualification and training in Bulgaria, the opinions of chemistry teachers on the necessity and forms of training aimed at the improvement of their teaching skills, as well as the strategies and approaches that enhance the development of ICT competences. The advancement of society today leads to rapid changes in science. Therefore teachers and educators should have solid and regular training to acquire new knowledge emerging in all spheres of life. An important aspect of professional qualification is the training of teachers in applying new, interactive, teaching methods in order to achieve higher interactivity in the educational process and to raise the interest of their students. A special emphasis is placed on practice-oriented teaching and classroom activities that encourage learners to be more active participants in the learning process. ICT training of teachers is directly linked to the mastering and application of new teaching methods.

Another 5 papers have been presented under the second thematic area “Teachers competences: modern student oriented pedagogical approaches”. Some of them are briefly described below.

Milena Kirova, from **Sofia University (Bulgaria)**, presented her paper entitled **“Pre-service Chemistry Teachers’ Training at Sofia University in the Frame of Technological Pedagogical Content Knowledge”**. Digital age poses serious challenges to chemistry teachers. A good teacher should be proficient in chemistry, pedagogy as well as technology. The framework Technology Pedagogy Content Knowledge (TPCK) describes these complex teacher features. The paper presents a study where the framework was applied for analyses of pre-service chemistry teachers' programmes at Sofia University. The results show some omissions in teachers' preparation. They should be taken into consideration and respective changes should be introduced to the programmes and to in-service teachers' training.

Violeta Konstantinova, a chemistry teacher from **Secondary School of Mathematics and Natural Sciences, VelikoTarnovo (Bulgaria)**, presented a paper entitled **“Formation and Development of Positive Students’ Motivation Toward Natural Sciences”**. In this article are described examples of students' activities, which are realized in extracurricular classes of Chemistry. The right of personal choice when the students work according to their scientific interests stimulates their independence, activity and even more manifestation of creativity when they prepare and present multimedia presentations, create posters, scientific essays and solve problems. The students' participation in different competitions contributes to the development of permanent, positive motivation; it also helps the awareness of the interdisciplinary links between natural sciences, engineering and contemporary technologies as well as contributes to reassertion of positive attitudes due to students' emotional involvement.





518300-LLP-2011-IT-COMENIUS-CNW

Galina Shumanova, from the **Center for Control and Assessment of School Education Quality, Sofia (Bulgaria)** presented the paper **“Pedagogical Experience in Making Criteria for internal Assessment in Accordance with the Curriculum of Chemistry and Environmental Protection”** (authors: Galia Shumanova, Lilia Ovcharova – Kirilova). Objectively evaluation for knowledge, skills and competencies of the students in modern educational process has important diagnostic value to check the capabilities of the students to learn the relevant educational content in the various subjects in the Bulgarian school. Important and mandatory condition is the students, depending on their age features, to be placed at same objectively conditions of evaluation in their achievements in the various school disciplines. At the internal evaluation assessing is the teacher. Evaluation is a process for establishing the achieved results and giving an individual assessment for every valuated student. This message aims to share the experience of the authors, involved in an expert group for elaboration of criteria for internal evaluation for chemistry and protection of the environment-7th, 8th, 9th and 10th classes, as well as Man and nature ,5th and 6th classes. In the paper is shown a small part of the example set matrices in developing a criteria for internal evaluation at the theme “Hydroxyl derivatives of the hydrocarbons “ studied in 9th class at chemistry and environmental protection and the relevant example tools of test tasks.

Vladimir Tsvetkov, **Chemistry teacher from “Georgi Benkovski” Primary school, Mirkovo (Bulgaria)**, presented the paper **“Application of the Problem-based Approach in Chemistry Classes”** (authors: Vladimir Tsvetkov, Elena Boiadjieva). Knowledge and understanding of science and technology is crucial for education and training of young people in today's society as it offers a number of requirements and challenges. It is expected from them to be proactive, to navigate quickly when placed in unfamiliar situations, to manage to identify the important information. This necessitates a change in educational policies related to the implementation of various educational approaches and methods. In this article is proposed and tested a method of using problem-based learning approach in chemistry. An empirical study with students from 9th grade was conducted which indicated a trend of positive attitudes to learning and successful formation of important key skills.

The 3th thematic area included papers dedicated to the methodology and modern approaches to each specific Chemistry topics. Some of them are briefly described below.

Darin Madzharov, the author and the main administrator of the educational website and platform **“Ucha.se,” Sofia (Bulgaria)**, presented a paper entitled **“Online Video Lessons on the Platform “Ucha.se” (<http://ucha.se/>) – innovative Approach for High Quality Education in Chemistry”** (authors: Maria Nikolova, Darin Madzharov). According to authors new methods should be used in contemporary education for increasing young people's interest and motivation in learning the science. Chemistry video-lessons in the educational platform Ucha.se are successful attempt in this area. In this article technology for creating a Chemistry video-lesson have been discussed. Advantages and disadvantages of this educational form are considered. Teacher's role and place video-lessons are discussed. The development of the platform provokes serious thinking about its future having in mind that video-lessons are consistent with the syllabus for obligatory education. The huge usage of the videos is examined (150 lessons are watched over 450 000 times for 1.5 year) and this proves the big benefit and usefulness from this form of education – quickly, easy and interesting; motivates the students by provoking their interest towards chemistry.

Krasimira Tomeva, from **Professional Mechanoelectrotechnical High School – Sevlievo (Bulgaria)**, presented her paper **“Club Activity as Pedagogical Approach to Enhance Students Interest Toward Natural Sciences”**. The objective of the paper is to show some aspects of the club forms and their role as an approach to increasing interest in natural subjects. Many schools in Bulgaria are involved in projects related to extracurricular activities. About 50% of students are involved in various forms of extra-curricular activities. Clubs were established in the areas of the sciences, healthy lifestyle, communication skills in a foreign language, cultural and digital competences. The focus is on equitable interaction of teachers and students in a joint activity. Students are active participants: artists, explorers and discoverers of knowledge, teachers are their mentors and supporters. The question is how training in these disciplines to make more suitable and meaningful to young people in a way that takes into account gender, culture and interests? What methods and approaches to choose to increase interest in science and the professions? Club activities prominently as a





518300-LLP-2011-IT-COMENIUS-CNW

prevailing form of extracurricular activities, promotes and develops a number of schools. Clubs offer students the opportunity for activities you like and who define themselves.

Galina Kirova, a Chemistry teacher from **Vocational Secondary School of Electronics “A. S. Popov”** and **Jenna Staykova**, a Chemistry teacher from **ARCUS American College, Veliko Tarnovo (Bulgaria)** presented their paper **“Earth belongs to all of us” – an Interschool Project on the Impact of Mineral Fertilizers**. The paper discusses the role of the interschool project as way to enhance the students’ interest in science and research. The cooperation between a vocational secondary school, on one hand and a college where students are taught in accordance with internationally acknowledged curriculum, where experimental activities are put to the front, on the other, breaks away from the standard ways of teaching

At the end of the session **live scientific show “On the edge of science and art”** has been performed by **Hristo Kolev**, from the **Sofia University**. The author of the show is a Science communicator and PhD student at Sofia University and a Chemistry teacher in Private American College in Sofia at the same time. He demonstrated how the complicated Chemistry and Physics issues could be presented to students in attractive and understandable way using simple and amusing experiments and “scientific toys”.

Conference Evaluation

At the end of the conference the participants have been asked to fill in an evaluation questionnaire. The areas covered by the questionnaire were: organisational aspects, conference contents, skills of the speakers and of the moderators, atmosphere during the conference and social events. The average value for all mentioned areas was 8 – 10 so in general the conference received a very good evaluation. The most liked about the conference was: the presentation of the educational platform “Uchase”; the variety of presentations of the new generation chemistry teachers; the live scientific show “On the edge of science and art” as innovative approach in Chemistry teaching. The most critical points were the role of the conference moderator in the interaction with the audience and the missing simultaneous translation of some of the Bulgarian presentations.

All interviewed participants answered that will participate in possible next edition of the conference. Some of them suggested also possible improvements of the conference organization in the future: to enlarge the time for discussions, dividing participants in small groups;

Some of the participants also made the following statements:

- The conference gave me possibility to meet specialists in the same field from other European countries and to learn new ideas, and to share our experience also.
- The conference organization was perfect and everything accurate!
- Very well organized conference! Thanks for the hospitality!
- The most I liked about the conference was to have contacts with Bulgarian researchers
- For me the most valuable was the positive attitude of the participants

Conclusions

Summarizing the results from the conference it could be said that the goal of the conference was fulfilled: it became a forum where the most important issues related to chemistry teachers competences and qualification as prerequisite to enhance the students interest in learning chemistry were discussed. National policy, good experience and practical solutions in organization of chemistry teachers training in the 11 European countries were shared.

Despite differences in educational systems the presentations of both foreign speakers and Bulgarian participants showed common problems also: the use of traditional methods of teaching the subject at school; the negative impact of factors as limited opportunities within the curriculum for experimenting different approaches for teaching Chemistry, lack of technical equipment, lack of language skills both of teachers and students etc., on Chemistry teaching and learning; the lack of competences of chemistry teachers in using ICT





518300-LLP-2011-IT-COMENIUS-CNW

based products and interactive materials to motivate students and enhance their interest towards Chemistry lessons. The participants came to the common conclusions that although there is 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 during the conference good practices in Chemistry teaching and use of ICT in classes prove that the science could be successfully incorporated in the lessons in attractive and amusing way so to make the complicated matter completely understandable and easy to learn by students. In this aspect, the conference correlates with the project aim to develop collaboration between university professors and researchers and secondary school science teachers so as to identify a common approach and 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. It also creates a bridge to the final Project's thematic area dedicated to Successful experiences and Good Practices for teaching Chemistry.

