



UNIVERSITÀ DEGLI STUDI  
DI GENOVA



N° 167126-LLP-1-2009-1-IT-KA1-KA1ECETB

## 'The CHEMISTRY IS ALL AROUND US Project' Promotion of Lifelong Learning of Scientific Subjects

### THE FINAL CONFERENCE

On February 1, 2011, the final Conference of the project was held in Genoa at the Aula Magna of the Department of Chemistry and Industrial Chemistry of the University of Genoa.

The **objective** was to sensitize people to the crisis of scientific disciplines (chemistry in particular) that is not only an Italian problem, but a problem shared among the European Countries. For this reason the production of a common strategy to fight the crisis has been the most important goal of the project and it has to be disseminated as a concrete proposal, based on the work of a team of expert and motivated researchers.

#### CONFERENCE INVITATIONS

Many telephone calls were done and many mails were sent to invite professors and researcher working at the University of Genoa, teachers working at the secondary schools of Liguria and people working in the field of education (scientific education in particular).

The following e-invitation was attached to the mails, provided with the Conference program:

The poster features a blue background with a large, tilted glass flask containing blue liquid. The flask has markings for 200 and 250. At the top, there are logos for the University of Genoa, DCCI (Dipartimento di Chimica e Chimica Industriale), the European Union flag, the Education and Culture DG Lifelong Learning Programme, and the 'Chemistry is All Around Us' logo. The text on the poster reads: 'Lifelong Learning of Scientific Subjects in Europe: a Common Approach for a Better Future', 'Conferenza a conclusione del progetto europeo Chemistry Is All Around Us', and 'Martedì 1 febbraio 2011 • ore 10.00', 'Dipartimento di Chimica e Chimica Industriale • Via Dodecaneso 31 • Genova'. On the left side, there is a vertical green bar with the text 'FACOLTÀ DI SCIENZE MATEMATICHE, FISICHE E NATURALI'.





## CONFERENCE PROGRAMME

### 10:00 Welcome

Maurizio Martelli, (Dean, University of Genoa, ITALY)

Laura Capelli (Regional Directorate of Education of Liguria, ITALY)

Giancarlo Albertelli (Director of the Faculty of Science, University of Genoa, ITALY)

Giovanni Carlo Alfonso (Director of the Department of Chemistry and Industrial Chemistry, University of Genoa, ITALY)

### 10:45 Giunio Luzzatto (CARED, University of Genoa)

*"Initial teacher training with reference to the scientific disciplines"*

### 11:30 Coffee Break

**11:45 Maria Maddalena Carnasciali** (Department of Chemistry and Industrial Chemistry, University of Genoa, ITALY)

*"Presentation of the Project Chemistry Is All Around Us"*

**12:15 Milena Koleva** (Technical University of Gabrovo, BULGARIA)

*"Scientific theater – a way for gifted children to take the floor and to raise interest in science"*

**12:40 Thomas Deharde** (Deutsche Angestellten Akademie GmbH Berlin und Brandenburg, DAA, GERMANY)

*"Training of chemistry teachers in Germany. The structure of the school system and the situation of chemistry. A critical analysis"*

### 13:15 Buffet

**14:15 Dionysios Koulougliotis** (Technological Educational Institute (T.E.I.) of Ionian Islands – Department of Environmental Technology and Ecology, Zakynthos, GREECE)

*"Barriers to lifelong learning of chemistry: a comparative study between adults and chemistry teachers"*

**14:40 Anna Mittnerova** (Institute of Chemical Technology in Prague, CZECH REPUBLIC)

*"How to attract young people to study chemistry"*

**15:05 Mustafa Bayrakci** (Kirikkale University, TURKEY)

*"Science teachers' in-service training in turkey: an analysis of practices"*

**15:30 Laura Ricco and Marina Alloisio** (Department of Chemistry and Industrial Chemistry, University of Genoa, ITALY)

*"Educational Package: basic rules to approach scientific contents in an amusing but rigorous way"*

**16:00 Maria Maddalena Carnasciali**

*"Strategy: the goal of our European team"*

### 16:30 Closure





## CONTENTS OF THE PRESENTATIONS MADE

### Giunio Luzzatto

CARED (Centre of the University of Genoa for the educational research), University of Genoa

#### ***"Initial teacher training with reference to the scientific disciplines"***

On the basis of the results of OCSE (2005), Teachers Matter, it is evident the necessity of attracting, developing and retaining effective teachers.

Teachers should have wider responsibilities towards the single student, the whole class, the school, the parents and the society. But to reach this objective the national policy has to ensure a good initial teacher training and a continuous professional update and to recognize the quality of the work by rewarding the most deserving teachers .

Institutions should have a policy and associated procedures for the assurance of the quality and standards of their programs and awards. They should also commit themselves explicitly to the development of a culture which recognizes the importance of quality in their work. To achieve this, institutions should develop and implement a strategy for the continuous enhancement of quality.

At present, the new reform for the initial teacher training provides:  
a specific three-years degree for new teachers owing a secondary school diploma  
a specific two-years degree for new teachers owing a secondary school diploma  
a TFA (internship) for new teachers owing a degree in ordinary disciplines

But the above structure is not completely active and its organization raises many doubts:  
Is the new teacher training system able to give adequate competences?  
Is it an exemplary system?

### Maria Maddalena Carnasciali

Department of Chemistry and Industrial Chemistry, University of Genoa, ITALY

#### ***"Presentation of the Project Chemistry Is All Around Us"***

The identified background of the project idea relies on the evidence of common needs within the countries involved and in Europe in general, related to the lack and insufficient diffusion of scientific culture and awareness, that starting from the school level (primary and secondary education) affects all levels of educational and training systems and therefore citizens in general.

Promoting Life Long Learning strategies for scientific issues is much more difficult, compared to other subject areas (e.g. humanistic subjects, business management, language learning) as when the compulsory education ends, those that are not interested in science are much more likely to completely abandon the subject.

To address this situation, the Chemistry Is All Around Us project intends to identify the existing successful strategies for the promotion of Life Long Learning in scientific issues and spread them through the potential of ICT, in order to provide a method and related educational tools, that can provide learners, starting from the school level, with the knowledge and the skills to be able to informally learn about science throughout their life.



Among the scientific fields, Chemistry is identified as an exemplary Case Study as it is recognized as one of the most problematic subject. That is because, Chemistry suffers from a growing unpopularity due to the fact that the media often makes improper connections between Chemistry and the ideas of pollution, health threats, manipulation of natural structures etc.

The Chemistry Is All Around Us Project intends to promote a comparison between the strategies implemented in the 6 countries involved (i.e. Bulgaria, The Czech Republic, Germany, Greece , Italy, and Turkey) for the promotion and diffusion of a more aware and interesting approach to Chemistry (chosen as exemplary case studies for scientific subjects) at all levels of the Educational and training Systems, in order to develop an internet portal, to collect, share and experiment with the best practices in the field.

### **Milena Koleva**

Technical University of Gabrovo, BULGARIA

#### ***“Scientific theater – a way for gifted children to take the floor and to raise interest in science”***

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.

In addition, as a part of the fundamental education in natural sciences chemistry learning in Bulgarian schools faces many serious problems also – difficult to comprehend content of course books, poor methods of teaching, outdated or unavailable laboratory equipment etc. Young people are poorly motivated for learning chemistry during and after the secondary school because there are no prospects for professional realization also. Chemistry is not topical because for many years it remains underrated and the material taught is not oriented to practice.

There are many strategies and initiatives at national and local level to stimulate the interest in learning of scientific subjects and of chemistry. An interesting approach to increasing interest in science called “a science theatre” is implemented at the Aprilov National High School – Gabrovo. It gives the floor to talented students with interest both in science and arts. Over the last four years three performances have been implemented, at present the preparation of the forth one dedicated to the International Year of Chemistry 2011 is in progress.

The technological process of establishing the scientific theater includes collecting of scientific facts for the particular subject and selecting proper experiments, Writing the script for the performance, creating a



theatrical performance, development of teaching materials required, procurement of props and creating scenery. There is a close cooperation between different teams during the working process. Participation of students is voluntary and on their own initiative - the role of teachers is only to coordinate work. As a result of the extensive work in the course of performances scientific knowledge, skills for conducting chemistry experiments as well as competence in science as a whole were formed.

The "scientific theatre" enriches and diversifies the ways of teaching science in the high school and increases interest of students in it

### Thomas Deharde

Deutsche Angestellten Akademie GmbH Berlin und Brandenburg, DAA, GERMANY

### ***"Training of chemistry teachers in Germany. The structure of the school system and the situation of chemistry. A critical analysis"***

#### FEDERAL ORGANISATION

The responsibility for the education system in Germany is in the hands of the different federal states, the so-called "Länder", making uniform solutions difficult but also allowing for experiments in education. The Standing Conference of the Ministers of Culture is responsible for coordination and adjustment of too many difference.

Teacher training therefore still differs, but the Standing Conference decided in 2008 on more common standards for the training of teachers.

#### Structure of School System

Germany has a three-tier school system and three different types of graduation. This means different access to higher education. To attend secondary or comprehensive school is the "direct way" to University. For all other graduations, an additional qualification is necessary. This makes permeability and accessibility of higher education in Germany a weak point in the German education system

#### Teacher Training

Teachers are trained to be a teacher at a primary, general secondary/ intermediate or secondary or comprehensive school.

Teaching in its content, methods and didactics is specialized for each school. Teaching at secondary schools means to teach closer to the subject, whereas teaching at general secondary schools etc. is more focused on practical aspects.

The teacher training takes place at a University, starting with a bachelor study referring to the chosen subject, e.g., Chemistry, Biology etc. To become a teacher, the student must complete a master study. The duration of a bachelor study is 6 semesters or three years. A master study, e.g., for teaching at a primary school, will take two more semesters (one year). The duration of a master study for secondary school usually takes 5 years at the university. The students graduate with a master of education.

After the graduation the teacher will have to do a two year traineeship (teacher's training course) which is finalised with the second state exam.

#### Chemistry teacher

The Chemistry teacher studies Chemistry as a core subject and has to choose a second subject, usually another natural science, for example, Biology or Physics/Mathematics.

#### Problems and Flaws

Chemistry teachers learn more about the subject Chemistry than about didactics, pedagogy or teaching methods. The professors or lecturers at the University are scientists and usually do not have any training in teaching, and there are mostly not interested in these important skills.

Interviews with teachers very clearly point this out: to be a teacher, at what school ever, means to teach and to motivate students to learn; not to produce a Chemist, but to produce someone who is eager to learn more about Chemistry.





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#### Good practice

A strategy for a solution to these problems could be a study model of the University of Oldenburg, which unfortunately never became a standard. The University offered a study programme closely intertwining University and school.

Three aspects marked this model:

Subject-specific didactics and teaching methods became an equal part of the study.

There were compulsory school internships from the beginning.

Internships and teacher's training courses were tutored by university lecturers and teachers.

The effects were that university lecturers got an insight into school (with its demands and challenges) and teachers could close up to new developments in their subject.

#### **Dionysios Koulougliotis**

Technological Educational Institute (T.E.I.) of Ionian Islands – Department of Environmental Technology and Ecology, Zakynthos, GREECE

#### ***"Barriers to lifelong learning of chemistry: a comparative study between adults and chemistry teachers"***

The study aims at identifying barriers to lifelong learning of Chemistry by following the method of case study analysis of the experiences of adult learners and chemistry teachers. Data collection was done with the method of personal structured interviews. The analysis of the answers of 10 adults who have not pursued studies related to Chemistry and 10 Chemistry teachers in secondary education, resulted in the following main difficulties of Chemistry learning: intrinsic difficulty of the subject, non-attractive teaching methodology with very limited reference to the connection of Chemistry with everyday life, very demanding chemistry curriculum, devaluation of the chemistry course in the educational system and in society, negative attitude towards chemistry.

Due to the above difficulties, the average adult possesses a low level of chemical literacy, he/she cannot easily comprehend the rapidly increasing amount of the relevant information in the media and encounters major barriers to lifelong learning of chemistry and scientific subjects in general.

#### **Anna Mittnerova**

Institute of Chemical Technology in Prague, CZECH REPUBLIC

#### ***"How to attract young people to study chemistry"***

Institute of Chemical Technology, Prague (ICTP) is the largest university of its kind in the Central Europe. Its main aim is to educate students in all chemistry disciplines and to carry out research and technology development. The university consists of four faculties, that are Faculty of Chemical Technology, Faculty of Environmental Technology, Faculty of Food and Biochemical Technology and Faculty of Chemical Engineering. At the university study about 4100 Bc and MS students, 300 foreign students, 860 PhD students and here works 880 employees, of which 414 people are academic staff. The history is dated back to the beginning of 19th century when the first Polytechnic institute in Prague was founded. Today, the university is independent public subject. The annual budget of ICT Prague is about 50 mil €, half of this budget is allocated to education. The amount of the funds allocated to education depends also on the number of students. Therefore ICT Prague promotes several activities to attract young people to come to study chemistry.



These activities are focused on

- secondary school teachers and their students, these are:
  - lessons of Modern Chemistry;
  - popularization of chemistry - project POPUCH;
  - summer schools on particular chemistry fields;
- general public, parents of teenagers, pupils of primary and secondary schools, these are:
  - participations on LLL exhibitions, fairs and events;
  - participation on the events popularising technical and natural science and chemistry;
  - participations in chemistry Olympia games;
  - organisation of open door days;
  - producing interesting and attractive web pages and other ICT products that make chemistry more understandable and friendly;
  - close cooperation with the media makers, journalists, radio and TV broadcasting programs focused on science and technology.

The lecture on the conference informs in detail about particular activities that are focused on above mentioned target groups.

### **Mustafa Bayrakci**

Kirikkale University, TURKEY

#### ***"Science teachers' in-service training in turkey: an analysis of practices"***

In modern education systems, in-service training is no longer seen as a remedy for deficiencies in initial training, but is already beginning to be considered as a long-term process and a part of continuing education. In many countries it is considered as a part of lifelong learning as well (Theunissen & Veenman, 1998). In-service training is accepted as an effective method of increasing the knowledge, skills and positive beliefs of teachers. It is a process used to continue the teachers' education once they have received their certification in teaching and are employed in a professional position (Locke, 1984).

The purpose of this study is to investigate and evaluate policies and practices about science teachers' in-service training in the National Education System of Turkey. The research was carried out by using qualitative research methods. The current situation of in-service training activities in Turkey was investigated through visits to the educational institutions and semi-structured interviews with relevant people. The results of the study indicates that the most important problems facing in-service training activities in Turkey are a lack of professional staff, no collaborative partnerships between teachers, no insight for lifelong learning, no provision for feedback and no systematic professional development model. According to the results of the study, suggestions are made about in-service training activities.

### **Laura Ricco and Marina Alloisio**

Department of Chemistry and Industrial Chemistry, University of Genoa, ITALY

#### ***"Educational Package: basic rules to approach scientific contents in an amusing but rigorous way"***

Papers and interviews collected during the first part of the project allowed to identify difficulties and obstacles of teachers and students in the teaching-learning process of chemistry:

- chemistry has a bad image: it is associated with negative aspects of life and considered as the antithesis of what is natural;



- chemistry is considered a difficult subject because it makes use of difficult language, microscopic and macroscopic level at the same time, mnemonic concepts, models; moreover it seems to be abstract;
- chemistry teachers are not adequate: many of them are not graduated in chemistry and most of them did not attend a specific training necessary to 'learn to teach';
- text books are too difficult;
- laboratory activities are absent or, in the best cases, sporadic or inadequate;
- there is a lack of motivation: students and adults think that chemistry is an abstract subject and do not manage to see its connection with everyday life. Moreover they have a superficial knowledge of the job opportunities for a chemist.

On the light of the above considerations few fundamental rules have to be followed in order to produce a good educational package about scientific topics:

- the contents of the educational package should be topical with links and examples in everyday life and able to arouse curiosity and questions.
- content explanation should be provided in a rigorous but simple way in order to not discourage people having inadequate basic knowledge;
- content discussion should also stimulate the need to know more;
- there should be the option to go deeper by gradually passing to higher levels of difficulty;
- pictures and figures (if possible not chemical formula) should be used to make easier the understanding of the text;
- the proposal of interactive actions (activities to do at home, videos to look, exercises) has to stimulate the discussion in order to make the training less cold and more amusing;
- activities should be closely related to the contents and achievable with materials inexpensive and easy to get;
- exercises should be coherent with the level of given information.

The educational package 'Polymers for special uses', uploaded on the project portal, is an exemplary application of the above rules.

### **Maria Maddalena Carnasciali**

Department of Chemistry and Industrial Chemistry, University of Genoa, ITALY

#### **"Strategy: the goal of our European team"**

On the basis of the results collected for the project, an agreement among the partners has been achieved in order to propose an effective and common strategy able to improve the lifelong learning of scientific subjects in Europe.





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All the activities that European Countries have pursued till now are not sufficient: they are sporadic, do not have wide diffusion and do not seem to be really effective in fighting adult distrust. A different and long term strategy needs to be implemented.

If all the events and the actions that are carried out in the six countries have not achieved the result of making Science appealing to both students and adults, it means that the problem has to be analyzed in a different way and dissected in all its components.

We think that if all children of the next generations will have extremely capable teachers, they will become good students and could become good teachers, good journalists or good researchers in didactics, but they certainly will be parents able to transmit the right approach to science, chemistry in particular to their children. All of them will be adults able to understand the importance of science and technology and to distinguish the difference between the right and wrong application of chemistry.

We ask the European Committee to sustain the necessity to have in Europe a greater consideration of didactic research, such as occurs in the USA.

Events would be prepared by teachers and didactic researchers to involve primarily children and parents and teaching at all levels has to receive more consideration from society, both the perception thereof and in remuneration.

### IMPACT OF THE EVENT

About 50 people attended the Conference. The number of participants has been not high because February is a very binding month for teachers because they meet to assign the term's marks. Many teachers were really interested in attending the Conference and communicated their non-attendance with big regret. In another period of the year the teacher's participation would have been much more numerous.

The evaluation of the project by the people attending the Conference was very positive and their help to sustain and disseminate the results of the project is guaranteed.

