518300-LLP-2011-IT-COMENIUS-CNW

Virtual Meeting

Networking Activity on "Teacher Training"

Meeting held 6 June 2013, at 3:00 p.m. CET

The video of the meeting is available on this Internet address:
http://flashmeeting.e2bn.net/fm/4d092c-16025

Participants

Partners

Lorenzo Martellini (Pixel), Zlata Selak (INFOREF), Julien Keutgen (INFOREF), Milena Koleva (Technical University of Gabrovo), Zdenek Hrdlicka (Institute of Chemical Technology), Marcela Grecova (Institute of Chemical Technology), Dionysios Koulougliotis (Technological Educational Institute), Koutelekos John (Technological Educational Institute), Selina Martin (CECE), Marie Walsh (Limerick Institute of Technology), Magdalena Galaj (WSInf), Maria Maddalena Carnasciali (University of Genova), Laura Ricco (University of Genova), Filomena Barreiro (Instituto Politécnico de Bragança), Olga Ferreira (Instituto Politécnico de Bragança), Murat Demirbaş (Kırıkkale University) Ömer Faruk Şen (Kırıkkale University), Hüseyin Miraç Pektaş (Kırıkkale University) Juraj Dúbrava (TRANSFER)

Teachers

Divna Brajkovic (Belgium), Mariagiovanna Ricciarelli (Belgium), Maria Nikolova (Bulgaria), Ilka Boyanova (Bulgaria), Galina Kirova (Bulgaria), Daniel Petkov (Bulgaria) Katusha Stancheva (Bulgaria), Katerina Salta (Greece), Antonio Jesus (Spain), Michelle Starr (Ireland), Rose Lawlor Starr (Ireland), Monika Smaga (Poland), Ola Smejda-Krzewicka (Poland),

Minutes

As an introduction Professor Maria Maddalena Carnasciali introduced the agenda of the meeting .

Teachers' opinions

Portuguese teachers

Filomena Barreiro (Instituto Politécnico de Bragança) reported Portuguise teachers experience concerning the activities realted to the teacher training thematic area. The workshop on Teachers' training promoted by the Polytechnic Institute of Bragança (IPB) partner was held in the School of Technology and Management (ESTiG) of IPB at 17 of May 2013 (16:00 CET), in Bragança. Nineteen persons, among teachers (13) from various school levels, IPB staff (5) and experts (1) were present. From the promoted discussion the following main conclusions/comments were made:

1. Teacher training

- In what concerns chemistry teachers, the initial teacher training (ITE) pattern in Portugal can be quite wide. From the analysis of the participant teachers, base formations (first cycles) in Chemical Engineering, Chemistry, Biochemistry, Physics and Physical-chemistry were registered. Continuous professional development training is therefore considered fundamental, not only as an actualization tool but also to surpass some existing lacks associated to base formation.

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

- It was pointed out, by the teachers, a lack of offer in what concerns in-service teacher training in the chemistry area, in the region of Bragança. In that context, the Chemistry is All Around Network project provided the opportunity to bring this point into discussion. Most of the involved teachers attended ICT related courses but not specific to chemistry teaching.
- Several topics for in-service training actions were focused. Among them, technological subjects such as “Environmental chemistry”, “Food chemistry”, “Polymer technology” and “Cosmetic chemistry” were referred. “Analytical chemistry”, particularly, the use of analytical equipment, was also mentioned. Moreover “Chemical sensors”, “Nuclear chemistry” and “Green and sustainable chemistry” were pointed out as pertinent topics.
- A special emphasis was put on the use of ICT resources and the way they can be connected to experimental activities in the laboratory. It was found interesting to develop orientated guides to support the use of ICT resources, either as an introduction to the experimental activity or as a tool to consolidate knowledge. More, it was found important to offer training focusing this duality ICT-experimental activity.
- In-service training was found essential to promote teacher’s actualization. This was found even more important in the region of Bragança where the opportunities for specialized training, focusing both in fundamental and technological chemistry areas, are reported as scarce. In that context, the IPB project team will promote the organization of in-service chemistry teacher training in cooperation with the training institution “Centro de Formação da Associação de Escolas Bragança Norte”, starting with the organization of the 15 hours course entitled “Instrumental Methods of Analysis”, during September 2013.

2. The use of ICT resources in teaching and portal resources analysis

- An overview of the portal was made to the participants putting in evidence the updates, mainly in what concerns papers and publications on the thematic “Teachers’ training”. An explanation of the forms to be filled was done, as well as, a remembering of deadlines.
- Teachers participating in the workshop reported that they use very often ICT resources to support their teaching activities. Among the cited resources the most used are: A Química das coisas (http://www.aquimicadascoisas.org/), Casa das Ciências (http://www.casadasciencias.org/), Ptable (http://www.ptable.com/) and Phet (http://phet.colorado.edu/pt/simulations/category/chemistry).
- ICT resources are found useful to support the explanation of concepts that are difficult to be visualized by students. The following examples have been cited: (1) concepts that involve microscopic level and (2) experiments that are impossible to perform in the laboratory (e.g. nuclear reactions). Moreover, simulations that are interactive, enabling students to test different variables/hypothesis were pointed out as the most effective.
- An example of good practices using simulations in an educational context was given: a class focusing acid-base titrations could be planned to start with the experimental activity followed by the computational simulation to visualize the microscopic level (ionic hypothesis) and to test the effect of changing variables (titrant volume, concentration etc.).

3. Other

- The project “A Química das coisas – The Chemistry of things” was presented by Professor Paulo Ribeiro Claro (one of our scientific experts) to the teachers. He reported a growing use of this resource as an educational tool, which was not foreseen in its creation. The participant teachers corroborate its value and reported they use it mainly as an introductory motivation element. According to them, its success relies on the fact of being scientifically rigorous and appellative, but short enough not to compromise the time needed to work with students.

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

- As an extension to the meeting, Professor Paulo Ribeiro Claro gave a seminar at Museu Ciência Viva de Bragança (one of our Associated Partners) open to teachers, students and general public. This activity entitled "The Chemistry of Love" is also one of the thematic of the above mentioned project "The Chemistry of Things". In the first part, there was a seminar and, after, a discussion with the public about the chemistry involved in this emotion, in particular, about the action of chemicals on the brain.

After the conclusion of the Portuguese report, professor Maddalena Carnasciali made some questions, focusing on the need to know something more about the lack of formative offer in the framework of in-service teacher training with reference to the chemistry area.

According to the results made available from the report, ICT resources are found useful to support the explanation of those concepts which are difficult to be visualized by students. In addition, interactive simulations enable students to test different variables or hypothesis.

Maddalena Carnasciali asked participants' feedback about the "Chemistry is All Around" Portal. Teachers recommended a reorganization of the topic "Teaching resources" in order to add more categories to the field "Type of product". According to the Portuguese team, the teaching resources available on the portal are too dispersive and it is necessary to proceed with their reorganization. Most of teachers applied for the courses, but, in the region of Bragança, there are not so many offers in the chemistry area . Lastly, with reference to the ICT resources, they expressed the need to use the simulation in connection with a laboratory work and to develop some guides addressed to teachers and students.

Irish teachers

Rose Lawlor Starr (Ireland) reported Irish teachers experience concerning the activities realted to the teacher training thematic area.

The Irish workshop on teacher training took place on May 28th 2013. The focus was Teacher Training and Continuous Professional Development, and the relevance of the Chemistry Is All Around Network Project to these.

The following items were discussed within an Irish context:

Consecutive Vs Concurrent training of student teachers.

The value of each type was significantly dependant on several key factors including the student; the particular philosophy of the department or third level institute; the delivery mode (and the 'lecturer') and the motivation or student's perception of what is a chemistry teacher

There are advantages and disadvantages to each method and a blend of both was ideal but difficult to achieve. However, content knowledge was identified as possibly lacking in some instances.

Pre-service and In-service training. To date pre service training for primary school teachers has not been evident. However, this is currently being addressed at undergraduate level but the benefits will not be seen for four years i.e. graduates of 2017.

In-service training in the Irish context is not a mandatory requirement for teachers at either primary or secondary level but uptake of such training where available is significant despite it usually being outside of 'normal' working conditions with no recognition by the education department nor incentive.

Probation and Induction – The group felt that a science mentor either within a school or locally among a community of schools would be of huge benefit to teachers. The potential for a third level lecturer to be engaged in such a role is worth exploring.

Continuous Professional Development; Courses run on a regular basis for second level teachers of science/chemistry and the need for these is evident in the fact that the courses are oversubscribed and that waiting lists exist.

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Discussion regarding the group's reviews of papers and publications on the portal site took place. There was broad discussion of the reviews.

Translation was an issue with regard to some of the papers.

Peer review prior to up loading on the portal might benefit in a positive way in the future of the project.

Papers that were contributing to the debate were in some instances based on what should be done in that particular European country and not on the current situation and it is hoped that some of the proposals will be realised.

The issue of publications over ten pages in length (some being books) was observed as being impractical for reviewers.

One recurring theme emerged, that of 'Misconception' of chemistry concepts by student teachers being passed on to the secondary level students.

The use of ICT was discussed. It was felt that while the future of the teaching of science/chemistry was most definitely with ICT given the prevalence of it in everyday life that there should be a focus on the technique of blended learning to include traditional teaching methods.

The following topics suggested by Marilena were discussed with regard to future work;

Methodologies to teach specific topics – The use of various media and ICT as tools for teaching which are either available as packages or a group based project were discussed.

An example was demonstrated to the group where students using as a core of a Chemistry themed song to develop an accompanying 'stills shot' video which visually explains the science of the song.

Other examples were discussed in depth and it was felt that such teaching was often time consuming and was too liberal as a method when the syllabus is so well defined. It was also felt that both students and parents are focused on the exam process and the final grade as opposed to the topic of chemistry. To that end it was felt that such a project style using blended learning should be incorporated into the learning.

The importance of **training science teachers to keep up to date** with the continuous progress of research was dictated by the recommended texts for the subject and the extra-curricular activities engaged with by teachers and students such as SciFest and the BT young scientist competition. It was felt that CPD also has a role to play here.

The **use of simulations** had a major drawback regarding cost and relevance to the syllabus. While there were many resources available the detail and relevance did not always match the syllabus learning outcomes and had limited use either being too detailed and in depth or not enough. There may be a possibility to develop such resources specifically for the Irish situation. Simulations did have a role in a blended learning environment. It was also noted that such learning resources are taxed at 23% in Ireland and possibly to a similar extent in Europe – The current project may be a good vehicle on a European level to repeal such taxes?

Teaching Resources:

Once again the usefulness and variety of the Royal Society of Chemistry's LearnNet was discussed. Another useful source uploaded by one of the partners is Amazing Chemistry Teacher Resources at www.nclark.net This is definitely a resource to recommend to associate schools.Before the workshop ended the group completed Portal Evaluation forms.

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Polish teachers

Magdalena Galaj from WSINF (Poland) reported Polish teachers experience concerning the activities realted to the teacher training thematic area.

Polish partnership, as well as the other national teams of Chemistry Is All Around Network project, was to organize a workshop related to teacher's training for teachers and experts till 31 May 2013. Things got postponed though due to the timing issue. May is one of the biggest months in Poland at lower-secondary and upper secondary schools. At both levels final exams are organized: Egzamin Gimnazjalny and Matura. Teachers are either involved in the preparation, invigilating or checking and marking students' exam results. In case of Polish Matura exam both written and oral forms are in practice so teachers and teacher trainers were very busy then. That is why WSIU was not able to organize the second workshop on Teacher Training on time. Another reasons why delays occurred were more of a personal kind and undoubtedly they had an impact on the delayed event, too.

Finally the event took place on 4 June 2013 at 15:00. Few dates and timings were suggested to the target group members and to our surprise the most spontaneous option was favoured by the majority. WSIU wanted to organize the workshop in the second week of June so that the teachers and experts had more time to prepare for the meeting but then it occurred that mid or end of June are not suitable, either do to the end of school and academic year. Mid of and end of June is an exam session at universities and polytechnics and then the main experts would not be able to participate at all.

The workshop started with welcoming and brief introduction to the project activities so far, mainly due to the fact that some new participants took part in the event. Two representatives of associated partner schools and one representative of associated partner institution got invited, too. Because the event was a bit of 'the spur of the moment' one, unfortunately some teachers and experts delegated a substitute because they were not able to join us in person.

The workshop followed our brief agenda. Newcomers were familiarised with the portal sections and its content and some practical issues were talked about. These mainly concentrated on the collection of comments by Polish teachers and experts on the materials uploaded online. We agreed on a commonly accepted solution in that matter to speed up the process as WSIU has not completed this task yet.

Then discussion moderated by dr Monika Smaga took place. It started with a short presentation of the Polish situation to let everybody realize the facts and figures and general career path development of an average chemistry teacher. She briefly reminded how long the basic training takes place with reference to hours and years and compared the ratio of theoretical and practical training for the average student. She pointed out the amount of hours spent in labs involved in experiments and compared it to the hours spent with the end user – student, in case of teacher training specialisation. Afterwards a live discussion took place.

The outcomes are the following:

- Polish student of Chemistry at University or Polytechnic is better prepared for teaching in theory than practise
- He/ she has access to equipment and chemical experiments when at Uni and then lacks these opportunities when starts proper teaching at schools, which do not even have proper chemical lab
- Educational reform in Poland interfered with the core curriculum development - for the last few years it got changed few times which results in disorientation and lack of cohesion of ministerial requirements and the factual learning outcomes
- Chemistry teacher is supposed to develop professionally (each teacher in Poland follows a career development process – 4 stages) but during the process his/ her chemical knowledge is not much verified
- Courses, workshop, conference and training participation are not mandatory, and usually if of higher quality, also quite expensive

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

- Polish chemistry teacher has to cater for his/ her professional development on the individual basis which may result in the lack of motivation and loss of quality of teaching
- Polish Chemistry teacher lacks good English language skills which is very limiting and can slow down self-teaching and restrict use of solutions applied by foreign chemistry market

Suggested solutions:

- Financial resources from the government to equip schools better and allow teachers to participate in free or at least cheaper, high quality trainings
- Access to initiatives such as Chemistry is All Around Network project and its free of charge resources
- Language courses for chemistry teachers

Examples of good practice:

1) Jagiellonian University – A language course for chemistry students and teachers - http://www.efch.jcj.uj.edu.pl

English for Chemistry: Film Bank is a non-profit project, aiming to provide materials for teaching English for Specific Purposes at B2 level in accordance with the Common European Framework of Reference to the students of the Faculty of Chemistry at the Jagiellonian University in Kraków.

The project was conducted in the academic year 2010/11 by third year students of this faculty under the supervision of Dorota Klimek, a teacher of English at the Jagiellonian Language Centre.

The film bank includes a set of listening comprehension exercises based on films concerning a variety of chemistry subjects, carefully selected from the multitude of materials available on the Internet. The films are accompanied by a follow-up section, consisting of complementary reading and vocabulary exercises. The materials can be used in the classroom and for self-study purposes alike. The files are also available as printable pdfs.

2) A project – "Z jedynki do Jedynki" – cooperation of I lower Secondary School in Lodz with the I Upper Secondary School – to help students develop chemistry oriented interests and help teachers cooperate and develop professionally, too.

Conclusions:

- Improvement of language skills is more than necessary – it would help teachers to implement ready-made, free of charge materials available in the classroom
- More external initiatives – trips to chemical plants, factories - facilitation of student research and interest
- Cooperation of schools, higher institutions and chemical industry both at local, regional and international level (Chemistry is All Around Network)

After the conclusion of the polish report, professor Maddalena Carnasciali asked how it is possible to allow techers to follow English courses, even if they are too busy. According to Magdalena Galaj, the only possibility is to revolutionize curricular structures during the studies. The proof stands in the fact that today graduated students have a better level of English language in comparison with the past. Anyway, they should still attend more English classes during their studies and develop a more specific language in the chemistry area.

Bulgarian teachers

Daniel Petkov (Bulgaria) reported Bulgarian teachers experience concerning the activities realted to the teacher training thematic area.
Workshop on Teachers' training under the Chemistry is all around Network Project was held on 17.05.2013 in the conference room of the University Library of the Technical University of Gabrovo. It was attended by

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

chemistry teachers from secondary schools associated of the Technical University - Gabrovo project, as well as representatives of universities and organizations as experts

The meeting took place in accordance to the previously agreed agenda, as follows:

- Introduction of participants;
- Registration; Introduction of participants
- Project "Chemistry is all around Network", thematic area “Teachers training” - future activities
- Lecture: Qualification of Bulgarian chemistry teachers – current situation, problems and solutions
- Chemistry teachers training: Bulgarian ad European realities - presentation of teachers’ and experts’ comments on papers available on project portal;
- Discussion:
- Teachers competences: modern student oriented pedagogical approaches;
- Methodology to teach specific topics. Use of simulations - pros and cons.
- Final remarks, conclusions

The workshop was organized in two sessions:

During the first part Assoc. Prof. Milena Kirova from Sofia University, expert in the field of chemistry teachers training and teachers’ ICT competences, presented lecture “Qualification of Bulgarian chemistry teachers – current situation, problems and solutions”.

She addressed the problems concerning qualification of teachers in Bulgaria (in particular, chemistry and natural science teachers), namely, the lack of modern normative basis regulating the teachers’ training, insufficient financial aid for teachers which has to provide for the qualification improvement etc. The role of the learning environment was presented as well as the scientific competence for the formation of pedagogic skills of the modern teacher.

The lector made a comparison with systems for teachers’ qualification in other European countries, whereas the positive experience of Portugal and Poland was mentioned.

After the lecture teachers and experts presented their comments on the publications and articles available on the Teachers’ training section of the project portal: The use of information and communication technologies by Portuguese teachers (Paiva, J., Paiva, J.C., Fiolhais, C.); Polish Education Reform and Resulting Changes in the Process of Chemical Education (Hanna Gulinska); Specifics of chemistry lessons at non-chemical secondary vocational schools; Information and communication technology and the problem of teacher training: myths, dreams and harsh reality; Improving pre-service elementary teachers’ education via a laboratory course on air pollution: one university’s experience; Evaluation of the impact of the training program in teaching experimental science: a nationwide study; Chemistry teachers’ perceptions on laboratory applications: Izmir sample; Teachers’ pedagogical competence as a prerequisite for entering the profession; Case study on mentoring in initial teacher training of science teachers in Ireland etc.
The presented lecture and the comments on Teachers’ training publications available on the portal launched discussion on the following main topics related to the thematic area of the workshop:

- Teachers competences - modern student oriented pedagogical approaches;
- Methodology to teach specific topics - use of simulations - pros and cons.

Following problems have been discussed:

- State educational policy, regulations and tools related to teachers' qualification actions;
- Teacher competence and motivation of teachers to improve their qualification;
- Bulgarian and European practice in teachers’ training;

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

- Student centered pedagogical approach and teaching methodology: the role of real laboratory experiment and ICT based tools.

After the discussions the participants in the meeting agreed on the following:

1. 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, to expand their competence, particularly those ones related to the use of modern technologies for educational purposes.

2. This raises some very important yet unsolved 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;

3. Chemical laboratory is a unique environment in which students may participate in various activities. Teachers have several main tasks in this process: to put the student at the centre of learning process using proper methodological tools and approach; to include interesting experiments related to the everyday life of people and the environment; to help students develop abilities to make sense of the terms, to collect and analyze data, to form research skills. Tools which support the teacher in these tasks are contemporary ICT as well as the rich base of interactive products; when combined cleverly with real laboratory experiments, they would significantly contribute to the students' motivation for studying the subject. This sets the requirement for teachers to develop skills to select and use proper computer applications during learning process or to create ones by themselves using certain products. That is why it is necessary to establish an overall system for teachers' training to apply ICT in teaching chemistry.

Turkish teachers

A Turkish teacher reported his colleagues' experience concerning the activities realted to the teacher training thematic area.

Workshop about training chemistry teacher was realized with 15 participants in Education Faculty of Kırıkkale University on May 29, 2013 . 3 of them were experts and 12 of them were researchers and teachers. the issues discussed and the following suggestions have been put forth about "Chemistry is all around Network Project".

Methodologies to teach a specific topics(e.g. acids and bases, the period table, …): analysis and comparison between positive and negative experiences

In changing and improving the education system of our time, the important point is to get student to be constructive, creative and inquisitive while appying the constructivist approach. For this reason, teachers have to use teaching methods which help student to be constructive, creative and collaborative and gain problem solving ability actively such problem-based learning when teaching of natural sciences such as chemistry based on fully implementing and monitoring (Özeken ve Yıldırım, 2011).

When opinions of the teachers considered, while using the activities based on problem-based learning in

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

teaching some topics was efficient, it was not for some topics. They emphasized that problem-based teaching activities provided meaningful learning especially redox reactions, the mole concept, atomic models, and titration. In addition, teachers expressed that this method had positive effects to have high motivation, attitudes, and gain problem solving skills, critical thinking, and cooperative behaviors. However, some problems were observed such as not being accustomed to the method, communication problems, shortage of time, and distribution of tasks in groups.
In the literature, teachers' thoughts revealed about regarding the implementation of problem-based teaching methods are contained in similar results (Tatar, Oktay & Tüysüz, 2009; Tosun & Taşkesenligil, 2012).

One of the techniques mentioned is game education technique. Looking at teachers' practices, the technique is more effective in primary and secondary education, and this method's effect is decreasing in later age groups. The reason for this is thought to be that young age students have more sense of curiosity for technology. For instance Karamustafaoğlu, Coştu and Ayas (2005) studied with 7th grade students on Periodic Table and Their Properties located in the science curriculum. Their aim was implementation instruction based on the use of simple tools and equipment and determination the effectiveness of the study. As a result the success which is obtained using the periodic table developed by simple tools and instruments have been identified not only reduction wrong understanding and misconceptions but also increasing interest and demand of the students towards science courses.

Pre-service and In-service training:
Training Pre-service and In-service Chemistry teachers is an important issue. In this regard, it is necessary that doing more and more applications, informed about new teaching methods and techniques, having enough knowledge about how to use measurement and evaluation for Pre-service teachers. Teachers have been made Emphasis on these issues at the workshop. Furthermore, teachers in service have stated that they are participated in many in-service training courses which are organized by Ministry of National Education, remaining the theoretical level and not very concerned with their fields. The courses should be more practical rather than theoretical.
Teachers have stated they know about Theoretical structure of methods but they have trouble with the application. For instance they have explained that they do not know how to use the methods and techniques such as analogy, concept maps, V-diagram, Case study. Önen, Mertoğlu, Saka and Gürdal (2009) studied with 104 teachers and 26 of them belong to branch of chemistry in their research that is named "In-service training of teachers on teaching methods and techniques to the Summary Effect: Öpyep Example (ISE)". Before ISE teachers stated that they used methods of teaching techniques such as laboratory, computer-assisted instruction, brain storming, event inquiry, group work, games, problem-based learning, Field-trip and direct observation, models. After the study of ISE teachers have stated that they will use methods of teaching techniques such as laboratory, computer-assisted instruction, concept maps, Field-trip and direct observation, projects, puzzles, model, drama, brain storming, discovery learning, case studies, story completion, problem-based learning, in the event inquiry, cooperative learning, group work , games, analogy, V diagram, part of teaching, case study.

Use of simulations and animations:
Issues related to the chemical course that is often abstract level so some issues may be difficult to make meaningful by students. In this regard, simulations, and animations are frequently used in science lessons. For example, Hameed, Hackling and Garnett (1993) studied about the effect of a Computer-Assisted Instruction package (CAI) on conceptual change.

They were applied the CAI Package that contains the Computer simulations to 12 chemistry students between the ages of 16-18 .The results of the study, including simulation computer-aided instruction have revealed that students' many of the misconceptions in chemical equilibrium. CIA Package has provided meaningful and lasting conceptually changes in the application of 12 students.

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Day by day simulation samples prepared for science teaching in interactive environment are increased. However, most of these simulations contain information that may be caused by students' misconceptions. Therefore, when we select of simulations, the validity of scientific knowledge must be checked. Teachers should have the necessary equipment how applied to simulations. Because, each simulation may be perceived as exact copy of the truth by the students. The difference between the actual situation and modeling should be provided by teachers
Learning and living is more in the forefront, the simulation experiments made with even if only simple ingredients should be avoided.
Thus, students perform active learning with gaining psychomotor skills.

Recommendations, guidelines for teachers:
Students' difficulties in learning chemistry topics should be determined; they should be arranged on the teaching of in-service courses for teachers. These courses should be planned activities for the use of technology. Interactive portals on the training of qualified chemistry (www.vitaminegitim.com,, www.morpakampus.com, etc.) that can be used by teachers and students should be done presentation and should be widespread. This portal should be free to access and up to date. Successful Teachers should be given to promote. Thus, the interest and motivation of teachers will increase further.

After the conclusion of the turkish report, professor Maddalena Carnasciali asked why is a problem that according to the report "some problems were observed such as not being accustomed to the method, communication problems, shortage of time, and distribution of tasks in groups." According to the turkish team
They have discussed some material. Methodologies increase the knowledge of what to do.methotds are different in terms of problem – solving . Some problems about their use by the teachers.

Greek teachers

Dionysios Koulougliotis (Technological Educational Institute) reported Greek teachers' experience concerning the activities realted to the teacher training thematic area.

The Greek National Workshop on Teacher Training took place on Saturday May 18th 2013. A total of 10 teachers and 5 scientific experts participated in the three sessions of Workshop.
In the first session, participants were asked to discuss the topic of the importance of teacher training by focusing on two themes: a) their personal experiences and b) the information provided by the Papers and Publications related to "Teacher training" in the project database.

- In relation with pre-service training, the majority of the participants reported that during their undergraduate education they received limited training related to psychology, pedagogy or chemistry education. Only the participants who have a first degree outside of sciences, (eg chemical engineers, nurses, etc.) referred to a useful 6-month course in psychology, pedagogy, student evaluation methods, and teaching, during their pre-service training. However, in Greece there is no official system providing certification for the teaching profession.
- In-service training included both negative and positive experiences. The negative aspects were related to the emphasis on theoretical information, the lack of clear educational objectives and focus, the limited length of the programs, the optional and sporadic nature of training. On the positive side, participants made reference to the utility of some ICT courses which offered training in the use of interactive blackboards and educational software, and the possibility to attend "live" experiments by more experienced teachers.
- Participants agreed on three main obstacles in their effort to use innovative teaching approaches in class: a) the conflict between the official school and of the non-official educational track (private tutoring), b) the anchoring of upper secondary school towards the Panhellenic exams for entering

Lifelong Learning Programme
This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

tertiary education institutions and c) the closed curriculum and student evaluation method which are imposed in both lower and upper secondary education all over the country.

- The discussion on the papers and publications of the database related to "Teacher Training" was focused mostly on the Irish, Italian and Polish papers and a Turkish publication. Some points of interest were the following: In Ireland, the obligatory practical training of at least 300 hours in Ireland and the overall support provided to the young teacher, in the Italian paper the special emphasis to teacher-student communication and to laboratory practice, in Poland the obligation for a chemistry graduate to have two additional years of training to become a teacher and finally in the Turkish publication the opposing attitudes that sometimes exist between chemistry teachers considering the role and effectiveness of teaching chemistry in the laboratory.

In the second session, participants were asked to have an open discussion and exchange of experiences and opinions on different teaching approaches of a chemistry topic.

- Regarding the teaching approaches, participants believe that it is very important to be as flexible as possible. A chemistry teacher should try and apply different approaches and tools (traditional and innovative) for the same topic. Students tend to get easily bored and the teacher should try to keep them alert and interested.
- The use of simulations and virtual laboratory experiments are considered a very useful teaching strategy. Personal experiences show that simulations attract students' attention and create enthusiasm among them, especially if they are interactive. Virtual laboratory can be useful for a non-experienced teacher or in the case of inadequate infrastructure. However, teachers also mentioned that the excessive use of simulations tends to make students severely unaware of the risks involved in real chemistry experiments
- In relation with the cooperative teaching approach, participants consider it presents many advantages but some disadvantages as well. Its implementation requires a lot of preparation and careful design from the teacher, who also needs to have developed special skills in managing groups.
- Finally, all participants agreed that it is necessary to include real life applications and examples in chemistry teaching. However, systematic collaborative work between scientists and teachers should be undertaken in order to didactically transform the complicated real life chemistry into school knowledge.

In the third and last session, participants were asked to make their own proposals on different issues regarding teacher training such as content and type of training.

- Participants agreed that the content of teacher training should include the following topics: laboratory techniques and active learning methods appropriate for each age group with practical advice for successful implementation, use of ICT in the teaching process, pedagogical dimension of teaching based on findings of educational research, psychological dimension of teaching, interdisciplinarity and update on new scientific knowledge and general trends in science.
- In regard with the type of training, the following proposals were made: Training should be systematic and organized with a constant rate (eg. for one specific week each year). It should be oriented to active participation and not passive transfer of theories. Taking into account the phenomenon of professional burn-out, it is preferable that in-service teacher training is not done in-parallel with work. Teachers should be given the possibility to get a leave of absence for a few months every few years in order to receive organized training. In addition, it is recommended that every teacher is given the possibility to update his knowledge on the current scientific trends by participating in special training programs that are done in collaboration with research centers and universities, or in exchange programs with foreign countries.

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

After the conclusion of the greek report, professor Maddalena Carnasciali asked what they intended by “the conflict between the official school and of the non-official educational track (private tutoring)” as main obstacle in their effort to use innovative teaching approaches in class. In Greece, with the exception of the official schooling system, there is a well extended private tutoring, which is used by students in order to get help for the most difficult class like chemistry,mathematic and physics. After the secondary class, in order to pass the panhellenic exam, students refer to the private tutoring as the only way to prepare themselves. For this reason, teachers find quite difficult to use ICT resources in order to motivate those students, who still prefer the tutoring approach.

Belgian teachers

Maria Giovanna Ricciarelli (INFOREF) reported Belgian teachers’ experience concerning the activities realted to the teacher training thematic area.

The meeting took place at *École Normale Catholique du Brabant Wallon* (ENCBW) and was organised by Nathalie Matthys, who trains future science teachers for 12 to 15 year old students. It gathered the experts and teachers from Liège and Louvain involved in the project “Chemistry is All Around Network”, a total of 17 participants.

Results Presented
Project activities:
The teachers and experts were reminded the main project activities: gathering interactive resources on chemistry and creating a European network. They received French translations of the papers and of various publications on teacher training so they can comment on them. We have received nineteen comments so far. Regarding resources, twenty have been identified and new resources are being created; these are listed by subject according to the Belgian curriculum. They still need to be experimented in class. Fourteen comments have been posted on resources.

1. ICT resources: Presentation of **“**New lesson sequences"

1.1 Using the Interactive whiteboard (IWB) and modelling as a complement of the experimental approach. Theme: discovering the chemical reaction

Divna Brajkovic presented a resource created in collaboration with Inforef on the chemical reaction for third year students (14-15 year old). This learning sequence associates experiments with the systemic approach.Therefore, activities (lab, phenomena observation, modelling) are structured so as to foster a progressive gradation of abstraction levels (macro- to microscopic). The IWB offers an open and interactive writing all along the sequence.

Varied ICT resources integrated on this support make modelling of phenomena, and thus abstraction, easier. These tools make it possible to vary visual supports to foster understanding of dynamic (observed or produced) phenomena. The student can make screen captures of films and animations to grasp important moments of certain phenomena.

Moreover, the important step of modelling is highly used in different approaches: atom and molecule modelling with the IWB, flash animations, a PHET animation and more traditional models (molecular models). This diversity of supports addresses different types of intelligence and thus helps learning complex phenomena.

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

This sequence is inserted in the "teaching resources" database and on Inforef. It was used during a training session for teachers (organised by CECAFOC).

1.2 The IWB at ENCBW: new lesson sequences being built with science students

Nathalie Matthys and a future chemistry teacher presented another resource created by students (future chemistry teachers).

1.3 The systemic approach (Jean-Luc Pieczynski)

This approach to learning is adapted to the complexity of reality. The vocation of science is to build models to manage reality intelligently. These instructions were used to build lesson sequences to be tested in class (conclusions en 2014). Those lesson sequences will use ICT resources created in collaboration with Inforef.
Examples of sequences

2. National synthesis on teacher training (presentation made by teachers training from university and higher school ENCBW)

There are two courses of study:

- *AESI*: the ***régendat*** (three years) takes place in schools and trains lower secondary school science teachers (12-15 year students). Focus on pedagogical contents;
- *AESS*: the ***agrégation***, achieved at university after a five-year training, is necessary to teach chemistry in upper secondary schools (15-18 year students). Focus on scientific content.

They both aim to the acquisition of a certain number of skills and include theoretical lessons, practical workshops and internships. There is an ongoing reform to harmonize university and non-university training, which should result in a new single structure scheduled for 2014.

3 Secondary and upper education chemistry teacher' training: the European project EC_2E_2N-2 project "Chemistry and Engineering Skills for Europe in 2020" (Bernard Leyh, chemistry didactic - University of Liège)

The University of Genoa is a partner in the project.

Bernard Leyh is a new associated partner. He presented this European project that has some similarities with "Chemistry is all around". Contribution to secondary teacher training. Associating training in chemistry and in chemical engineering.

Activities:

- An e-book addressed to teachers and focusing on "good practices". It contains the most relevant topics for the members of the group work such as: teaching and learning in chemistry, classroom experiments and their goals and effects, different methods and media to be used in chemistry classes
- Question Bank "E-Chem-tests" type It focuses on the disciplinary, pedagogical and didactic contents http://ectn-assoc.cpe.fr/network/ec2e2n/

4. ACTIVITIES 2013 on teacher training (publications, comments, synthesis)

To conclude the meeting: presentation by the partners of the publications and papers on the portal, explanation of forms and reminding of deadlines.

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Czech teachers

Marcela Grecova (Institute of Chemical Technology) reported Czeck teachers' experience concerning the activities realted to the teacher training thematic area.

Czech team, as well as the other national teams of Chemistry Is All Around Network project, was to organize a workshop related to teacher's training for teachers and experts till 31 May 2013. However, we experienced huge difficulties trying to invite the teachers since they were extremely busy due to the school leaving examinations. We collaborate mostly with secondary school teachers. The leaving examinations at secondary schools *("maturita")* present currently an important issue in the Czech Republic. The rules have been changed recently. The exam conditions used to be the competence and responsibility of individual schools, leading to uneven quality of provided secondary education, impossibility to compare the schools and facilitate the admission at universities. Usually, oral exams prevailed.

Thus, a new system of leaving examinations certified by the state has been created recently. It comprises two parts, the first, written exam, is certified by the state and unified for all schools. The second part is usually oral and the level of knowledge and other conditions are scheduled by a particular school. Because some severe problems occurred in the first years, the system is being developed and adopted. For instance, at first, the written tests were evaluated by the company governed by the state. After series of complaints, some of the tests were evaluated by the teachers again but due to the enormous business this obligation has been returned to the company. So, the teachers have to cope with constantly changing conditions and have to study new schedules. This together with the second, school part of the exams causes that the teachers are extremely busy in the period of leaving examinations that lasts usually all the month of May. Although we did our best to make them come, many of them did not want or were not allowed to take part in our workshop.

For the reasons described above, the workshop has not taken place yet and will be held on 13 June 2013. We would like to apologize for any inconvenience.

Nevertheless, several teachers have already written their comments and we are able to conclude some important findings.

Training of teachers once they have graduated from universities is not spread and obvious activity in Czech Republic. Of course, some workshops and training lessons are organized but the general interest is not high. We would like to emphasize that courses for teachers are not mandatory. There are no rules of systematic teachers` training and career growth.

Some principals try to improve the reputation of their schools by encouraging the teachers to attend professional courses. However, busyness of Czech teachers is a major problem (not only in the period of leaving examinations described in the introduction). They have no time for trainings and for partnership with our project.

Some of the courses are certified by the Ministry of Education and the graduates get a diploma. Individual workshops could be divided according to their focus on various competencies of teachers:

1. Teachers training in the chemical area

a) News in science: *Otevřená věda* (Open science): Workshop connects the world of science and teachers. It shows new trends in science and finds new ways how to motivate students. http://www.otevrena-veda.cz/kurzy-pro-pedagogy/ov-kurzy-pro-pedagogy.html

b) News from the rules of working with chemicals - safety of teachers` and students` work

c) Innovation training of future teachers of chemistry: Palacký University (Olomouc), (1.1. 2011 –

31.12. 2013) http://ucitelchemie.upol.cz/

2. Training of pedagogical competencies

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

a) New teaching methodology: Project *Čtyřlístek* (Quatrefoil) in the Liberec region

http://www.portal-ctyrlistek.cz/cs/fotogalerie/skoleni-ucitelu-chemie.html

b) New *maturita* (leaving examination) training: it is necessary to instruct teachers how to work with new *maturita* which is time-consuming and teachers feel more busy.

http://www.novamaturita.cz/vzdelavani-pedagogu-1404033799.html

c) Methodological Portal RVP (general education programs): online workshops, databases, information sources, handbook for teachers. (www.rvp.cz)

3. Training in new technologies:

a) How to work with an interactive whiteboard (from February 2012, high school Teplice):

http://www.gymtce.cz/index.php?sectionID=100

b) How to create a presentation, how to use new media, etc. (Google, may 2013, but many other terms in different cities)

http://google-cz.blogspot.cz/2013/05/granty-google-sance-az-pro-tri-stovky.html

c) Video website at chemistry teacher's work: Book
http://www.muni.cz/research/publications/952384/

4. Language competences

Learning English is necessary to be able to cooperate with international projects and seek new knowledge in the field of chemistry in international databases. The insufficient teachers` knowledge of English is an issue also in CIAAN project. There are teachers who would like to cooperate but they do not speak English at all or only a little. Although the main parts of the portal have been translated to national languages, everything cannot be translated. For instance, these teachers cannot comment some teaching materials available in other languages only. For this reason, we have not obtained sufficient number of 30 comments.

-Course for Chemists in Pilsen, October 2012: http://www.nidv.cz/cs/kontakty/krajska-pracoviste/plzen/plzen.ep/237_1055-odborna-stredoskolska-anglictina-pro-chemiky-a-strojare/1/?PHPSESSID=d6ea8af8fd51bfe72dc55e0341d2530d

5. Books targeted to teachers

a) First steps of teacher (Podlahová) - instructions for graduates to get your bearings in a new school, how do you ensure that the authority to be included in the teaching staff and manage climate in the classroom.

b) An educational experiment in chemistry (Karel Holada) - Paper comes within UN -Year of Chemistry 2011- at the Charles University. Paper is targeted to students and teachers in practice.

Who trains?

a) Universities that have grants from the European Commission

b) Independent entrepreneurs (e.g. Google, language schools)

c) Training organized by the Ministry of Education, Youth and Sports (MEYS)

and other

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Spanish teachers

A Spanish teacher reported her colleagues' experience concerning the activities realted to the teacher training thematic area.

Workshop on Teachers' training under the Chemistry is all around Network Project was held on the 3rd of June of 2013 in Santo Tomás de Villanueva School in Granada. Twelve people, among them teachers (6) from various school levels and experts (university professors and scientists)(6) were present.

During the meeting, participants were asked to discuss the following topics:

- Teacher training courses in Spain.
- Methodologies to teach a specific topic, analysis and comparison between positive and negative experiences.
- The importance of scientific knowledge and pedagogical content knowledge and the need of training science teacher to keep them updated.
- The use of ICTs: videos, simulations, webquests and suggested resources.

They came to a variety of conclusions:

Teacher training:

- The current teacher training program (a sixty credit master) has a lot of limits. Teachers finish their university studies with huge lacks of didactic knowledge. The first part of the program is about general teaching but without specific science teaching contents. These specific contents will be explained during the second part. Some teachers and experts suggest starting up the Master with these contents that connect their scientific knowledge to teaching contents.

- University teachers can also attend teacher training courses. We can find pre-service and in-service training courses available to teachers, and an evaluation system is in place in which the teachers are evaluated through a student satisfaction survey, but the survey results are not recognized by some teachers.

- Participants agree that there is a training available for secondary and university teachers. One can find in-service training programs but they are not compulsory and only teachers with a strong interest in sharpening their knowledge and teaching activity take the courses.

- Some teachers suggested the use of online training courses and highlight the growing importance of social networks. A lot of Facebook and Twitter profiles offer scientific contents like news, discoveries and current events. Some of these contents are designed by experts, and provide teachers with a wealth of updated information on the world of science and technology.

Methodologies to teach:

- Most of participants agreed that the application of new methodologies in classroom is difficult due to lack of time and resources. Most of teaching programs are too long and theoretical and many textbooks are designed for teachers who apply a traditional methodology. All the participants stress the need for a methodological change in the teaching of contents like chemical formulation, whose current approach discourage students related to chemistry.

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

- University teachers observe big differences between first courses students. More than a third of first courses students don´t know basic facts about chemistry and how it is related to daily life. This may be caused by a lack of science contents in the educational pathway or by a wrong educational approach of science.

- Some participants suggest an investigative teaching methodology, and propose that we begin our classes introducing experimental devices, or everyday phenomena and to follow a more interactive approach by allowing time for learners to ask questions or make comments before starting theoretical concepts. One of the everyday approaches proposed was one resource that some authors name “Kitchen Chemistry”, illustrating some chemical principles through cooking experiments.

- In some schools teachers are applying approaches related to Howard Gardner's concept of multiple intelligences and promote creativity in the classroom. Activities like alternative representations of the periodic table of the elements or the creation of educational videos and theatre performances have a great impact on student learning. In this context, the use of Science History and STS contents with the students was proposed.

- One of the most important resources mentioned during the meeting was the use of laboratory practices. Organizing them is very difficult and they must be suitably prepared if we want to assure their successful completion. The Inorganic Chemistry department of University of Granada is developing a training innovation project called “Chemistry from another point of view” (La química desde otras ópticas), that promotes laboratory practices in schools and shows students how scientists do their job in the university laboratories. The experiences made with some schools have been very positives.

- Visiting Science Museums like the Science Park of Granada is another interesting teaching resource. The activities in science museums that have thoroughly been prepared in schools beforehand involve an improvement in science teaching for primary and secondary schools, showing the way in the right direction every year with holding of “Science fairs” created with the students direct involvement.

- All the teachers and experts in the meeting agreed on the need for institutional support in the cooperation between universities and schools. Every year some initiatives are launched, but not enough. University experts and secondary teachers asked for this cooperation and they had the idea of creating “laboratory kits” with guides and basic equipment to distribute to schools upon request, but always with the economic support of the government to ensure their sustainability.

ICT resources**:**

- Most resources proposed by the teachers who attended the workshop can be found in the portal of “Chemistry is all Around Network”. Websites like “The periodic table of videos” or “A química das coisas” by, or “Periodic table of Elements” by Benito Navarro have been applied with success in some secondary classes.

- Some participants suggest visiting some new places:

    - The facebook profile of “Real Sociedad Española de Química (RSEQ)” https://www.facebook.com/pages/Real-Sociedad-Espa%C3%B1ola-de Qu%C3%ADmica/120321771460907?ref=ts&fref=ts

    - The Blog about chemistry “El cuaderno de Calpurnia” http://elcuadernodecalpurniatate.blogspot.com.es/2013/06/calpurnia-en-las-ondas-4-blogs-espacios.html?showComment=1370416530524#c3245582124154169632

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

- The meeting participants proposed the creation of an open mailing list, a blog or a facebook profile where we can share all the interesting links we find in the future. Both university experts and teachers agreed on a commitment to work together and increase and support all initiatives on the way to mutual collaboration.

Italian teachers

The Italian workshop on teacher training was held in Genoa at the Department of Chemistry and Industrial Chemistry of Genoa in May the 28th.
The workshop agenda was:

1) Methodologies to teach a specific topic: analysis and comparison between positive and negative experiences
2) Consequences of lack of opportunities to experiment different approaches and methods for teaching and learning Chemistry
3) Importance of training science teacher keeping them updated with the continuous progress of the research
4) Use of simulations: pros and cons
5) Identification of recommendations, guidelines for teachers

The participation in the workshop was not large as expected because meetings for the students' final evaluation were called by most schools in that date.
Meanwhile, some teachers of the associated schools, recently joining the project, accepted the invitation to the workshop and contributed interestingly.

We present here only the most interesting conclusions which are considered useful for the project.

1) Methodologies to teach a specific topic (e.g. acids and bases, the period table, …): analysis and comparison between positive and negative experiences

Textbooks and the indications for the curriculo lead to teach too many subjects and in a premature way. One of the main difficulties is to have to introduce the atom structure even in the lower secondary school. A superficial teaching is one of the consequences of this approach as well as wrong concepts taught to the students. Short lab experiences are often used to help. Teachers realize that learning to use some types of ICT could facilitate to teach some difficult concepts, thanks to the displaying and the mobility of simulations (e.g. the simulation about molecular polarity, from PhET site was appreciated).

2) Consequences of lack of opportunities to experiment different approaches and methods for teaching and learning Chemistry

Laura Ricco gives evidence of her training work for the teacher training course she is attending (TFA). Her work took place in Anna Pitto's classes, a teacher supporting the project. This drove to discuss about the necessity to have training courses in order to experiment different approaches with the purpose to get a methodology setting-up suitable to teach chemistry better than ever. Laura experimented some ICT resources in the classes; these resources had been selected the previous year and the joint comment from both the trainee and the expert trainer was very interesting. The main emerging consideration is that students, being well skilled on computer science just for playing, are to be trained to suitably use the computer for educational objectives .
Also the cooperative learning has been discussed, because it represents an important resource to stimulate student participation and collaboration in order to get significant learning. Antonella Lotti, researcher in science of education and belonging to the national team supporting the project, is expert in Cooperative Learning and

Lifelong Learning Programme
This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Problem Based Learning. She proposes to organize a short course to train teacher to use these methodologies with their students.
This proposal has been seriously considered and the work group is thinking to resort to the cooperative learning in association with the use of ICT teaching resources.
The above considerations show that it is important to have the opportunity to experiment different approaches and methods under the guidance of experts (both in the discipline and in psychology and pedagogy) in order to avoid numerous mistakes depending on the lack of experience.

3) Importance of training science teacher keeping them updated with the continuous progress of the research

The work group claimed the necessity of keep a strong link between the teaching and the progress of the scientific research. This updating is useful in order to keep in mind the context where the students will apply their knowledge and to give them suitable hints, ideas and connections with their life.
Knowing the evolution of science and technology means to teach in a more critical way, being aware that the rules do not exist in nature, but we lives in successive approximations. They are models that are modified as the instruments of investigation become more sophisticated.

4) Use of simulations: pros and cons

The discussion on ICT resources has highlighted the difficulties that currently schools have in using them.
The first problem is that the number of computers is not sufficient to meet the guidelines of the Ministry of Education that encourages the development of digital skills; in some cases the internet connection is not available in the computer room.
The second problem consists in the lack of teacher training to use digital tools and applications. Teachers feel obliged to use them but they do not know how make them effective for learning.
On the base of the testing made by the teachers supporting the project, ICTs can be effectively included in the teaching-learning process because the student reaction has been positive and their interest seemed to be motivated.
But, few words of caution: ICTs have to be included in a significant way in a wider learning path, because if they are used as detached objects they can produce negative effects (loss of time, distractions of the class, transmission of misconceptions...). In this way ICTs can be real teaching resources and not simple tools.
For this reason it was decided to produce guidelines for the use of ICTs that have been tested and those that will be tested in the coming months. These documents will contain suggestions for educational paths that can be followed and supported by the above ICT resources, tips and considerations from teachers and experts. They will be uploaded on the project portal.

5) Identification of recommendations, guidelines for teachers

We also discussed about the possibility of building a resource to teach chemistry that meets the criteria set during the first year of the project: scientifically valid, simple to use, interactive, problem solving. Experts gave willingness to cooperate and to contact IT staff; teachers showed interest to identify some basic chemical paths in which introducing the use of ICT resources while indicating suitable times and ways, basing on their tests.
The workshop concluded with the commitment of teachers to present the workshop results to their school colleagues.
All participants expressed their intention to build and test during the next school year at least one teaching unit that foresees the use of ICT resources uploaded on the project portal.

Conclusion

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

The participants from Spain proposed the creation of an open mailing list, a blog or a facebook profile where we can share all the interesting links we find in the future. Both university experts and teachers agreed on a commitment to work together and increase and support all initiatives on the way to mutual collaboration. The participants from WSInf concluded that Improvement of language skills is more than necessary it would help teachers to implement ready-made, free of charge materials available in the classroom More external initiatives ,trips to chemical plants, factories facilitation of student research and interest Cooperation of schools, higher institutions and chemical industry both at local, regional and international level. According to Professor Maddalena Carnasciali, the main difficulties are similar in all the countries:1) teachers are too busy (the Italian one work enough but really don't like meetings) 2) teacher training is perhaps not much considered, although the strategic role it covers 3) ICT recourses are interesting but it is necessary to use them with attention.

She thanked everyone for the good work which will be surely continued in Gabrovo.

Lifelong Learning Programme

This project has been funded with support from the European Union.
This material reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.