



518300-LLP-2011-IT-COMENIUS-CNW

Chemistry is All Around Network
Workshop on "Teacher Training"
Athens, Greece, 18 May 2013

Minutes

Participants

The workshop was coordinated by the Project manager Dr. Dionysios Koulougliotis. The following 15 people (teachers and experts) participated in the workshop:

1. Karachaliou Ioanna (Teacher) from 3rd Lyceum of Koropi
2. Salta Katerina (Teacher) from 2nd Experimental Lyceum of Athens
3. Korfios Vagelis (Teacher) from 3rd Lykeio of Korydallos
4. Kappatos Stamatios (Teacher) from 1st EPA.L. Schimatariou
5. Sarigiannis Ioannis (Scientific Expert) from University of Patras
6. Fytrou Margarita (Teacher) from 2nd General Lyceum of St. Dimitrios
7. Papatheodosiou Kalliopi (Teacher) from 2nd General Lyceum of St. Dimitrios
8. Vachliotis Theodoros (Teacher) from 2nd Lykeio Irakliou Attikis
9. Nikolopoulos Dimitrios (Scientific Expert) from TEI of Piraeus.
10. Kordatos Konstantinos (Scientific Expert) from National Technical University of Athens
11. Mylona Anastasia (Teacher) from 2nd Experimental Lyceum of Athens
12. Niki Rapti (Teacher) from 5th Geniko Lykeio Petroupolis
13. Kalachanis Vasileios (Teacher) from 127th Primary School of Athens
14. Koutelekos John (Scientific Expert) from TEI of Athens
15. Sanakis Ioannis (Scientific Expert) from NCSR "DEMOKRITOS"

Minutes

9.30 – 9.45

The participants were welcomed to the workshop by the project manager (Dr. Koulougliotis) and subsequently they were asked to divide into three groups of five people each so that each group contains one or two scientific experts. The following three groups were made: Group 1 containing participants 1-5 of the above list, Group 2 containing participants 6 - 10 of the above list and Group 3 containing participants 11-15 of the above list. Subsequently, the project manager made a short presentation of the so far achieved results in the project and the agenda of the meeting was adopted by all participants.

9.45 – 11.00 (1st Session)

In this part of the workshop, there was a discussion on the importance of teacher training by focusing on two main themes: a) personal experiences of the participants and b) the information provided by the Papers and Publications related to "Teacher training" in the project database. A few explanations were given by the workshop coordinator on the aims and scope of this session. Subsequently, participants were given a specific amount of time (ca 30 minutes) to freely interact with the other members of their group and discuss the specific topic of this first session. At the end of this free interaction, each group was asked to present the main conclusions of their in-between



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discussion via one spokesperson for a maximum period of 10 minutes. Here are the main conclusions reached by each separate group:

a) Group 1:

The participants of this group sorted their experiences in two time periods: pre-service and in-service. During their undergraduate education as chemists, they received practically no training related to psychology, pedagogy or chemistry education. Some of them had some exposure to teaching methodologies via attending some seminars. All participants entered the profession by considering as a prototype their school teachers.

In-service training included some negative and some more positive experiences. The initial training received by the regional training centers (PEK) was not really useful since it was mostly theoretical information of superficial nature, mostly related with administrative and organizational issues. All participants had the opportunity to receive additional training by attending different optional programs: the practical course of 100 hours (Meizona Epimorfosi), practical courses organized by EKFE (Regional Secondary Education Laboratory Center for Physical Sciences), practical courses in ICT. The first of the above three programs had a clear aim and orientation related to the cooperative teaching approach and group management. The other two programs did not have clear educational objectives and focus. The type of the training at EKFE (limited length, no active participation of the trainee) as well its content (types of experiments with no suitable teaching approach) makes the training provided not very effective. A positive aspect of the ICT courses has been that a teacher can learn about the existence of different educational software and also how to use them. All participants have also completed the Masters Program in "Chemistry education and new educational technologies" and consider it overall a very useful and rewarding experience.

The group agreed on three major obstacles in the effort to use novel teaching approaches in class:

- a) the conflict created from the co-existence of the official school and of the non-official educational track (private tutoring - Frontistirio),
- b) the anchoring of upper secondary school towards the Panhellenic exams for entering tertiary education institutions
- c) the closed curriculum and student evaluation method which is based on specific page numbers from the textbook and imposed in both lower and upper secondary education all over the country.

Considering the first obstacle, we note that the majority of students receive simultaneously some type of private tutoring in all science courses and thus they are trained to consider chemistry learning solely as learning both exercises and exams problem solving techniques in order to get a good grade in the exams.

In regard with the different papers and publications of the portal database special reference was made to the situation presented in the Irish and the Italian papers, as well as a Turkish publication. The obligatory practical training of at least 300 hours in Ireland and the overall support provided to the young teacher via different initiatives are worth noting. In Italy, there is a lack of organized teacher training and special emphasis is given to the teacher-student communication and to laboratory practice which has to include hands-on activities designed by the student. Finally, the Turkish publication brought out the opposing attitudes that often exist between chemistry teachers considering the role and effectiveness of teaching chemistry in the laboratory. More specifically, one group of Turkish chemistry teachers supports strongly the laboratory approach via impressive



experiments which bring out the connections with everyday life and another group holds the opinion that there is a lack of suitable infrastructure, design and time availability for effectively implementing the laboratory teaching approach. Another interesting note made in the Turkish publication is the fact that the attitude of a chemistry teacher toward laboratory practice is very much dependent on his own experience as a student (either in secondary school or in tertiary education).

b) Group 2

The participants of this group also discussed the Italian and Irish papers and agree with what was mentioned by the previous group. In addition, starting from the Irish paper, they had a long discussion on the credibility and scientific accuracy of the publications that are related with the effectiveness of different teaching approaches. This type of research is sometimes carried out in a non-systematic way and the statistical analysis is either non-existent or rather poor. The teachers who read these publications need to be trained on understanding the quality and the accuracy of the results. According to this group, this is an important issue, because someone one can get the wrong message if he/she fully adopts all reported suggestions.

In agreement with the previous group, this group also agrees that teachers' training in Greece is inadequate and especially pre-service it is often practically absent. They pointed out the fact that the large majority of science (chemistry, physics, biology) laboratories of public schools lacks basic materials and in this way a science teacher finds many difficulties in applying laboratory-based teaching methods. The teachers who invest time and effort in getting a Masters degree in chemistry education, acquire significant practical and theoretical knowledge in innovative teaching methods; however, they get very little chance (if any) to apply such techniques in class due to the need to follow the "closed curriculum" and "cover the material". They also mentioned the competitive relation between the official school education and the private tutoring system ("Frontistirio") which leads students (especially in upper secondary school) to aim only in acquiring skills for solving exam problems and exercises.

The participants of this group referred to the "light" and "superficial" attitude with which teachers' and students' education is treated in Greece. They based their opinion on

- a) the sporadic nature of teacher training programs
- b) the little time allocated to chemistry teaching
- c) the content of teacher training programs

Special reference was made to the importance of content knowledge by the teacher. Knowledge in pedagogy and didactics is necessary, however a chemistry (and science) teacher should first of all be trained in the deep knowledge of content. Students appreciate a lot a teacher who "knows his/her stuff" and the teacher's self-confidence for his/her knowledge can also act as an effective motivational factor for the students. Teachers' misconceptions are transferred to their students.

Finally, some of the group participants referred to the positive effect created by the use of interactive blackboards which are present in several classes of Greek lower secondary schools. Even though their use is not obligatory by all teachers, it is important that an interested teacher can use this teaching tool. Reference was made to personal positive experiences from the use of interactive blackboards.

c) Group 3

This group agrees with the previous two groups that they had very limited training for the teaching profession in their undergraduate years and that the in-service training provided by the regional training centers (PEK) has been of very little use. However, the teacher training received at SELETE/ASPETE has been quite useful. This is an organized pre-service teacher training program that lasts 6 months and provides training in psychology, pedagogy, student evaluation methods, teaching methodologies and techniques. Unfortunately, this program is required only for people who have a first degree outside the main core of sciences, for example engineers, nurses, etc. In this way, holders of a Bachelor in Chemistry, Physics, Biology or Geology are not required to attend the program at SELETE/ASPETE. Another positive experience has been the study for acquiring the Masters degree in "Chemistry Education and New Educational Technologies" and the practical courses organized by EKFEs. It is useful to be able to see an experiment before one can show it to the students, which is something that today can also be done via YouTube. Of course, the training provided at EKFE is optional and getting a Masters degree is optional as well.

In general, the problem in Greece is that there is no official system providing certification for the teaching profession. In addition, teachers do not receive systematic training in evaluation methods and techniques both of the students and of themselves (self-evaluation). A special reference was made to the Polish paper in which it is mentioned that a chemistry graduate should have two additional years of training as a teacher (after the 3-year training as a chemist) in order to enter the teaching profession. In addition, the Polish system gives importance to lifelong training and update of science teachers.

Finally, a lot of discussion was made in relation to the Greek curriculum design and content which needs to be updated in order to incorporate modern and real-life applications of the chemistry concepts and knowledge presented. Students do not understand why they have to learn the specific material and teachers are also not in a position to help the students realize the connections of the different pieces of knowledge with each other and with real-life. Emphasis should be given in acquiring more in depth knowledge and not try to learn a little of everything. One should choose quality over quantity.

11.15 – 12.30 (2nd Session)

In this part of the workshop, the aim was to have an open discussion and exchange of experiences and opinions on different teaching approaches/methods of a chemistry subject. The discussion was focused on two main themes: a) Participants' opinions and training on innovative teaching approaches with emphasis on simulations and virtual laboratory applications, b) Personal experiences of the participants from the implementation of innovative teaching approaches in class. This session was carried out in a similar way with the first one. Here are the main conclusions reached by each separate group:

a) Group 3

First, it was pointed out that students tend to find difficulties in certain chemistry topics and some of them are the following: chemical reactions and stoichiometry, molecules and atoms. Regarding the teaching approaches employed, the group participants believe that it is very important to be as flexible as possible. By "flexible" they mean that a teacher should try and apply different approaches

(traditional, inquiry, problem solving) and different tools (simulation, blackboard, interactive blackboard, lab work) at the same topic,. Students tend to get easily bored and the teacher should try to keep them alert and interested by employing different approaches (traditional and innovative) and interchanging them. According to this group, this is a key issue. One teaching tool that some members of this group had the chance to use in class is some simulations of Phet related to stoichiometry, models of atoms and molecules, bond breaking and creation in chemical reactions. In general it works well. As far as novel approaches, one group member referred to a successful experience in the use of cooperative work in small groups for a specific project. Of course, it should be noted that the group of students (8 persons) was very carefully selected and it was one single project during one semester. It is not easy to apply this method to many students at the same time and in addition it requires a lot of effort, energy and dedication from the teacher.

The group participants agree with the Italian paper that it is important that the students perform the experiments on their own, collect the data, discuss the results between themselves and with other groups, present their results. It is important that the experiments make use of common materials in order to make the students realize that chemistry is present everywhere. Finally, they referred to some experiments that were received well by their students and which have some connection with everyday reality: measuring the melting point of materials such as a candle, butter and chocolate and watching the diffusion of a pigment used in pastry cooking.

b) Group 2

This group initially focused on teaching methods and strategies such as concept mapping in combination with elements of inquiry for teaching different topics of organic chemistry. One of the teachers of the groups pointed out that he has seen very good results via the use of this type of strategies.

The group also expressed the opinion, in agreement with the Group 3, that a teacher needs to be in a position to use all kinds of teaching methods (traditional and not) depending on the topic; no method is perfect and the multiple use can guarantee that the advantages of one will make up for the disadvantages of another one.

The use of simulations and virtual laboratory experiments are considered by the majority of the group members a very useful teaching strategy. Their personal experiences show that the virtual laboratory attracts students' attention and creates enthusiasm among them, especially if it is interactive, ie if the students are asked to actually participate in the activity and not just watch it. It is stated that the virtual laboratory can be useful for a non-experienced teacher who is very worried about student safety or in the case of inadequate infrastructure (lack of materials etc).

As far as cooperative teaching is concerned, it is believed that it needs a lot of preparation and careful design from the teacher so that the students do not have the impression that they are just playing a game and they do not need to try and learn anything since it is not a real class. However, the group members are keen on trying to practice this teaching approach.

In regard with the connection of chemistry with real life applications, the group expressed the opinion that even though it definitely awakens student interest, it often requires a lot of in depth knowledge from the teacher, since real life phenomena involve very complicated chemistry (for example biochemistry, environmental chemistry etc.). At this point, some teachers from the same and the other two groups intervened and pointed out that there exist some easy real life applications (eg. common materials which act as acids or bases, estimating the amount of water vapour in a

bathroom) which can be exploited didactically. In addition, it was agreed by all participants that it is necessary to include real life applications and examples in chemistry teaching but because real life chemistry is often very difficult, what should be done is systematic collaborative work between scientists and teachers in order to transform the complicated academic knowledge into school knowledge that can be didactically exploited in a high school classroom.

Finally, the group mentioned the following obstacles for the application of innovative teaching approaches by the teachers:

- a) the limitations set by the closed curriculum (a lot of material to teach – very little time),
- b) lack of infrastructure (in laboratory but also in computer terminals)
- c) anchoring and dependence of the whole educational system (especially in upper secondary school) on the exams for entering tertiary education.

a) Group 1

The group members share similar thoughts and opinions with the other two groups and they wish to enrich the discussion by adding two new issues that have come out of their personal experiences from the use of educational software and simulations (virtual laboratory) during instruction. One issue is related with the need to use cooperative teaching approach with the virtual laboratory applications since there is no possibility for each student to work on his own personal computer. The teacher needs to have developed special skills in managing groups. Even though the cooperative teaching approach has several advantages, it also presents disadvantages. For example, some groups finish their tasks earlier than others and they end up getting bored and spend time by playing games or surfing in the Internet while waiting for the other groups to finish. In addition, the group has found out that the use of educational software and simulations tends to have better results mainly on students who already have intrinsic motivation to learn chemistry and they possess basic knowledge in computers. The students who belong in either of these two categories tend to get more easily discouraged and do not receive much benefit. In addition, the excessive use of simulations tends to make students severely unaware of the risks involved in real chemistry experiments. This fact may influence negatively their future avocation with chemistry. Obviously, experimental simulations have significant importance when the laboratory infrastructure is insufficient. However, there are some lingering questions: how can the students be tested on the knowledge acquired? How are the experimental simulations related to the curriculum material and the other topics taught in class?

12.45 – 14.00 (3rd Session)

In this last session, participants were asked to make proposals on different aspects of teacher training. More specifically, the discussion was focused on three main themes: a) Content of teacher training, b) Type of teacher training and c) Teacher training institutions. This session was carried out in a similar way with the previous ones. Here are the main conclusions reached by each separate group:

As far as the content of teacher training the group made the following propositions:

- laboratory techniques
- use of ICT in the teaching process
- Pedagogy (cooperative teaching and other methods)
- Results reached by the educational research related with the application of innovative teaching methods, evaluation of these methods, practical advice for their successful implementation
- Interdisciplinarity (connections between chemistry and other disciplines such physics and biology)

As far as the type of teacher training, the following propositions were made: Training should be systematic and organized with a constant rate (eg. for one specific week each year) Training should focus on practice and not on theory.

Finally in respect with the issue of who should carry out the training, the group pointed out the need for teachers to get updated with recent findings of scientific research and proposed that it would be useful if teachers could get the opportunity to “join” active research groups of a University as guests. They also have the opinion that the training should be carried out by a group comprised of researchers (either from university or research centers).

a) Group 3

This group made the following propositions in respect with the content of teacher training. The subjects they propose are the following:

- active learning methods appropriate for each age group
- pedagogical dimension of teaching based on findings of educational research (both quantitative and qualitative)
- psychological dimension of teaching (motivation to learn, adolescents’ psychology, interaction with classmates, cognitive level of students and how to address different types of students, for example talented and not-talented ones, etc.)
- first aid, hygiene and safety at work, students with special needs
- history of science

In-service teacher training should be provided in the context of personal professional development and taking into account the phenomenon of professional burn-out, it is recommended that every few years (for example 5 years) teachers should be given a leave of absence for a few months in order to receive organized training. In addition, it is recommended that every teacher is given the possibility to update his knowledge on the recent 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. A lot of discussion was done on this possibility and an interesting proposition was the one of rotation between different research groups of a tertiary education institution.



518300-LLP-2011-IT-COMENIUS-CNW

The group believes that ideally teacher training should be organized by a central special institution that will ensure the access of all teachers to information related to training via the creation of a database. Several institutions should collaborate in order to create this special training institution originating from academia (Universities, TEIs), centers from pedagogical and scientific research, etc.

a) Group 1

The group agrees in general terms with the proposals of the other two groups and summarizing the following arguments can be made:

The following subjects should be included in the content of training:

- a) Pedagogy and psychology
- b) Practical application of teaching approaches (cooperative and others)
- c) Update of new scientific knowledge and general trends in science and transformation of this knowledge into teaching material.
- d) Results of educational research

In regard with the type of training, the proposition is that in-service training should not be done in-parallel with work but a leave of absence should be given to the teacher in order to participate in the training program. The group also mentioned the syndrome of professional burn-out that often affects the teaching professionals. The method of the training program should be oriented to active participation and not passive transfer of theories.

Finally, the group believes that there is no need for creating a separate institution responsible for teacher training and proposes collaboration between existing institutions (for example University and School domain). It is important of course that this collaboration is done by following a specific context and set of guidelines.

14.00 – 14.30

In this part of the workshop the participants were asked to fill the project evaluation questionnaires. Some general concluding remarks were made by the project manager. All the material collected will be used as effectively as possible for the production of the second national report.