

# Limerick Conference Report

## Initiatives in Chemistry Teacher Training

### Second Conference on the thematic area

### Teacher Training



**Limerick Institute of Technology, George's Quay**  
**Limerick (Ireland)**  
**29<sup>th</sup> November 2013**

## Introduction

The international conference “Initiatives in Chemistry Teacher Training” took place in Limerick on 29<sup>th</sup> November 2013 in Limerick Institute of Technology City Campus at George’s Quay. The aim of the conference was to share European experiences and initiatives for pre-service and in-service training of chemistry teachers and then to focus on initiatives to enhance chemistry teacher training from an Irish perspective. The Conference was funded by the 518300-LLP-2011-IT-COMENIUS-CNW Chemistry is All Around Network project resources. It was part of the prescribed activities of the Chemistry is All Around Us Network and follows on from the initial conference on Training Issues of Chemistry Teachers in Gabrovo, Bulgaria in June 2013.

## Conference Organisation

A Scientific Committee was formed to moderate the organisation of the conference. The members are listed in Appendix 1. The Conference was a one-day event, with the morning session centred around the European experiences collated through the Chemistry is All Around us Network Project, and the afternoon devoted to various aspects of chemistry teacher training in Ireland, and beyond, since some of the initiatives were instigated as part of European collaborations.

Some of the experts attending this Conference presented the outcomes/results of their research on a poster. Therefore, in addition to the conference talks, poster presentations were displayed, giving the participants had the opportunity to examine the posters presented and to discuss their contents with authors during the breaks midway through the morning and afternoon sessions. The conference programme is available both on the conference web site (<http://www.lit.ie/ICTT/default.aspx>) and as appendix to this document.

## Conference Participants

Some forty participants registered from a number of European countries, with the largest representation from Ireland. These included representatives from universities, schools, educational companies and public authorities. The complete list of participants is available both on the conference web site (<http://www.lit.ie/ICTT/default.aspx>) and as an appendix to this document.



## Conference Contents

During the conference, 20 papers were presented. As described in the previous paragraph the papers were organised to give trans-European perspectives on teacher training in Chemistry before focussing on initiatives in Ireland.

All presented papers are included in the conference proceedings which are available online on the Conference website (<http://www.lit.ie/ICTT/default.aspx>). Additionally, all papers have been published in a book by Limerick Printing Company.

The participants were welcomed to the George’s Quay campus by Michael O’Connell, Limerick Institute of Technology’s Vice-President for Strategy, Internationalisation and Marketing. His welcome was echoed by Michelle McKeon-Bennett, Head of Department of Applied Science in Limerick Institute of Technology. The

Chairperson for the day was David Sutton, a lecturer in the Department of Applied Science in Limerick Institute of Technology who is also a member of the Irish team of experts for the Chemistry is all Around Us Network Project.

The papers presented addressed Initial Teacher Education and In-service Education, with some of them focussing on the use of information communications technologies to enhance the teaching experience, as well as continuous professional development in the use of inquiry-based strategies.

**Maria Maddalena Carnasciali** presented a paper entitled *Initiatives in Chemistry Teacher Training in Italy: Significant Testimonials*, which was co-authored by Laura Ricco. The paper described the Italian scenario about training of science/chemistry teachers in Italy and presented a report on results of two important projects that offer in-service training to teachers, both of which are coordinated by the Department of Chemistry and Industrial Chemistry of Genoa. A summary of the responses to a survey of “senior” and “junior” teachers was also presented. This concluded that there is a need for financial support and good planning to ensure that teachers of varying backgrounds and experience are offered significant continuous personal development to ensure a good balance of subject content knowledge and pedagogical skills training.

The Greek situation was presented by **Dionysios Koulougliotis** in a paper *Pre-service Primary School Teachers Ideas in Chemistry Preparing and Retaining High Quality Chemistry Teachers in Greece* which was co-authored by Katerina Salta. This paper outlined research carried out to explore the experiences and beliefs of in-service Greek chemistry teachers in respect to their training and their classroom practices via qualitative analysis of data collected during workshop activities. This showed that, with the exception of pre-service subject matter, all other dimensions (pedagogical, psychological, social, ICT) were either inadequate or absent. A total of 13 factors were identified to have influenced the effectiveness of the received training with seven and six producing a negative or positive effect respectively. Four major obstacles which teachers face in their efforts to implement novel teaching approaches in the classroom were identified. Analysis of the workshop material also resulted in several proposals and suggestions related with different aspects of teacher training, namely the content, the type and the responsibility for the training program. The structures of the Greek education system are a drawback but the conclusion of the paper was that the views on in-service teachers could and should inform the design of teacher training programmes..

**Julien Keutgen** presented an account from Belgium of *Chemistry Teachers' Training in the Fédération Wallonie-Bruxelles* which was co-authored with Zlata Selak of Inforef. This described the current system of teacher training in the area, which is different depending on the school level in which the teacher aims to be employed. It went on to outline a project of structural reform of teachers' initial training that is currently under consideration and aims to change the structure of the upper education landscape. The project intends to extend the non-university training cycle in order to harmonise it with university training and to build new frames of reference of skills. All secondary school teachers would therefore be trained in the same way. This approach has to redefine the profession of teacher in its multiple missions: pedagogic, didactic and as a social and cultural partner.

A paper on *Chemistry Teachers' Training in Slovakia* by Katarína Javorová was presented by **Juraj Dúbrava**. This explained the current structures for teacher training in Slovakia and outlined some initiatives. However, the system seems to be fraught with difficulties and the need for overhaul of pre-service and in-service training was underlined. The need to establish professional standards and mandatory continuous professional development programmes for teachers was emphasized.

**Ana Pereira** presented *In-service teacher training in Portugal: Objectives, organisation and impact on teacher's career* on behalf of her co-authors O. Ferreira, A. Silva, E. Afonso and M.F. Barreiro. According to Portuguese legislation, teachers' training is organized in three different categories: Initial training, Specialized training, and In-service training. Restructuring of the initial teacher education programmes as a result of the Bologna Process was described. The authors also sought opinions of teachers involved in the Chemistry is All

Around Us Network project, and concluded that professional development support, particularly in practical laboratory work and ICT resource use, was essential.

*Teacher training in Turkey and an analysis of the recent status* by Murat Demirbaş, Mustafa Bayrakçı, Nazmiye Başer was presented by **Mustafa Bayrakçı**. This paper reviewed the current systems for initial teacher education in Turkey. The need for reform was once again highlighted. The authors conclude, 'the future of a child is determined by his/her elementary teacher instead of parents. It is possible to say a child is lucky in his/her elementary period if the teacher has advanced skills, a good personality and if he/she is able to provide qualitative education. A good teacher builds up a good future. So, the teacher training applications should be arranged carefully and should be applied efficiently'.

**Milena Koleva** represented her colleagues Milena Kirova and Adriana Tafrova-Grigorova to describe *Chemistry Teachers' Training Realities in Bulgaria*. The issues and challenges of teacher training and qualification are a special point of discussion among Bulgarian institutions within the context of the continuous (over 20 years) reform of Bulgarian education. Milena described the situation regarding pre and in-service training of Chemistry teachers in Bulgaria. She also outlined the contribution of the Chemistry is All Around Us Network Project to the debate on teacher training needs. The International Conference on Training Issues of Chemistry Teachers held in Gabrovo in June 2013 was a logical continuation of the project activities on Teacher Training. More than 60 participants from 11 European countries attended the Conference, among them representatives of universities, schools, educational and public authorities. The participants came to common conclusions that despite differences in educational systems there are common problems also. Although protocols for teachers training have been established in the different countries, there is a common need of clear policy and regular activity in science teachers' training to guarantee their permanent professional development and, thus, the high quality of the educational process.

*Science Teachers Training in Spain* by Antonio Jesús Torres Gil was presented by **Cristina Gaitán**. This explained the new Masters structure for initial teacher training which has been implemented in Spain. The strengths of this new programme include: High degree of implication and motivation from teachers and students; The Master can become a permanent teaching instrument for tutors and a initial training tool for prospective teachers; it reinforces the relationship between universities and secondary education teachers; it advocates the use of virtual environments and teachers are offered a wide range of courses to specialize. However, the Master has a number of identified weaknesses: too hasty implementation of the Master; lack of coordination between institutions and teachers involved; economic criteria as a priority in the design of the curricula activities; lack of coherence between teaching models expected to use in the classroom; teacher's courses are not compulsory and, last but not least, lack of time for teachers to attend training courses.

**Zdeněk Hrdlička** presented a paper describing *Teachers' Training in the Czech Republic* which he co-authored with Marcela Grecová and Veronika Popová. The main problem identified by the Czech authors was non-uniformity of the education system in different universities. This has resulted in a varying quality of graduates, which in turn affects the quality of teaching performed by these graduates. The presentation outlined the responses to a survey returned by 78 teachers at a summer school. The majority of the respondents were teachers with considerable amounts of in-service experience. One section of the survey asked teachers what is the biggest problem in their practice. This question was answered most extensively: Lack of funding leads to: poorly equipped laboratories, out-dated classrooms, lack of chemicals, small wages, and unavailability of materials; Textbooks are out-dated (with out-dated terminology and information); Lack of interconnection among science subjects; Laws restrict chemical experiments. The availability of materials produced through European collaborations was discussed.

Recent (2012) Polish educational reforms which introduced new objectives for teaching and learning were explained in detail by **Magdalena Gałaj** based on her paper, *Chemistry Teacher Training in Poland*. In Poland 'Chemistry for life' is promoted through research and experiment. The overhaul of the teaching system has dictated that Pre-Service training is available only for two- cycle programmes. However, In-Service Teacher training is optional and required only when developing ones teaching career in spite of the fact that programmes and courses available both at local and regional levels.

The morning sessions concluded with a review of *Initiatives in Chemistry Teacher Training in Ireland* by **Marie Walsh**. This outlined the current status of reform in all education components in Ireland, which, in the case of teacher training, have been informed by the Sahlberg Report (July 2012). This concluded 'in order to advance further in its national teacher education system, Ireland needs to invest more in the continuous improvement of the quality of teaching, the role of research in teacher education, and international cooperation in all of its teacher education institutions'. The current system of pre-service training was described, with some comparison of concurrent versus consecutive training and the implications of each for subject content knowledge and pedagogical skills training. Continuous professional development to maintain the state of the art in a scientific discipline like Chemistry was recognised as being vital. To this end the talk merged with one by **Peter Jackson**, who described the role of the *Professional Development Service for Teachers* (PDST). He is a practising Chemistry teacher who is also a member of the PDST team for Chemistry. He explained the work of the team and their countrywide interaction at Teachers Centres. They ensure material presented at training sessions is useful, are forward-looking, cross curricular links are stressed, making resources available to all teachers and they address literacy and numeracy issues.

The conference lunch was held in the Hunt Museum, which was a short walk away from the venue for the talks. This gave participants a chance to meet partners from other countries and to discuss the issues in a less formal setting.



When the participants reconvened at George's Quay they heard an overview of the *Chemistry Is All Around Network Project: The Transnational Report* by M.M.Carnasciali and L.Ricco and presented by **Marilena Carnasciali**, the project leader from University of Genoa. Her report showed how the project network is expanding internationally. She has concluded that the project is making a valuable contribution to the training of teachers because it allows the experts to deal with the international reality and increase their knowledge in the field of training and to discuss with teachers of all levels, establishing a solid contact with schools, their problems and needs. It also has allowed the teachers involved to have people to contact for improving their teaching methodology and for all users of the portal to update on teaching chemistry in Europe and find ideas for new teaching methodologies.

The afternoon sessions then shifted focus to Irish initiatives. Talks were given by representatives of Chemistry and Science Education Research Groups in a number of Irish third level institutions with involvement in either or both pre-service and in-service training of teachers. Many of the presenters are members or associates of the Chemistry is All Around Us Network in Ireland. The first of these talks was from **Peter Childs**, one of the pre-eminent chemistry education researchers in Ireland. His talk *From SER to STL: translating science education research into science teaching and learning*, encouraged the implementation of research findings into teaching and learning.

The theme of 'Misconceptions' was a major component of *Pre-service Primary Teachers Ideas in Chemistry* by **Maeve Liston**. She shared her on-going research findings regarding the scientific knowledge of pre-service primary school teachers and also described proposed future work to redress the misconceptions issue: to design and implement the Conceptual Understanding Chemistry Course where the pre-service teachers will be confronted with 'chemical events' that evoke conflicts between everyday conceptions and chemical theory.

The theme continued with a description of on-going research with pre-service secondary school teachers at the University of Limerick in *Investigating and Addressing Chemistry Misconceptions in the Subject Matter Knowledge and Pedagogical Content Knowledge of Pre-service Science Teachers* which was outlined by **Muireann Sheehan** and co-authored by Peter Childs. Their research has shown that the level of misconceptions is high, and worryingly, that it does not decrease over the lifetime of the undergraduate training programme. Phase 2 of the research includes design of a blended-learning intervention, including a website subatomic. The intention is that this website is a place where the Pre-service science teachers can: revise their own understanding of lower second-level (Junior Certificate) chemistry topics, learn about common pupil misconceptions which they may come across in the classroom, get diagnostic questions, resources, ideas for teaching activities and information about the Junior Certificate science syllabus, learn about research ideas and strategies relevant to developing conceptual understanding and targeting misconceptions among their pupils, and, get advice from experienced teachers/researchers about teaching chemistry (in the form of short articles).

The next two talks shifted emphasis to the use of ICTs in chemistry teaching. **Claire McDonnell** from Dublin Institute of Technology addressed the topic *Applying Technology to Enhance Chemistry Education*. Claire described her experience as a guest editor for the Royal Society of Chemistry special themed issue of the journal *Chemistry Education Research and Practice*, before going on to talk about her own experiences of using Wikis and Peerwise. One telling quote has resonance for all: "Technology will not replace teachers, but teachers who use technology will replace the teachers who do not," Clifford, R. (Defense Language Institute) quoted in Moeller, A. J. *CALICO Journal*, 1997, 14 (2-4), 5-13.

**Mark Glynn** from Dublin City University spoke on *Using Moodle for sustainable professional development for teachers*. This talk gave an overview of the potential for Moodle, both for in-house back-up for lessons and also for distance training initiatives.

After a short break to allow discussion and viewing of posters, the final talks of the day commenced. The first of these *The use of Visual Aids for concrete learners: Facilitating understanding in Organic Chemistry* was presented by **Anne O'Dwyer** (in conjunction with her supervisor Peter Childs), who demonstrated her research findings supporting the use of models to facilitate understanding of structures and reactions of organic molecules. She spoke about the multi-dimensional nature of Chemistry, cognitive development and its impact on the learning and understanding of abstract ideas – and particularly the cognitive demand of Organic Chemistry. The talk concluded with illustrations of the potential for using concrete models to teach abstract concepts.

**Sarah Brady**, from the CASTEL Centre for Advancement of Science Teaching and Learning in Dublin spoke about *Developing and Implementing Teacher Education Programmes & Resources for teaching Chemistry*, on behalf of her colleagues, Odilla E. Finlayson, Deirdre McCabe, Paul van Kampen, James Lovatt, Eilish McLoughlin. She shared the group experiences of developing and implementing teacher education programmes and resources for teaching chemistry. This work has been made possible through CASTEL's involvement in two particular projects. The first is the ESTABLISH project, which is an FP7 Science in Society coordination and support project which they coordinate and the second is the Amgen Science Teacher Training Initiative, which has been run as a pilot project for the last two years. Two positive results from these initiatives have been: observed changes in the profile of teachers' understanding of Inquiry based science education and very significantly buy-in from Ministries of Education to roll out national programmes of continued teacher professional development.

The final talk of the afternoon was on *Technology Enhanced Learning in the Chemistry Classroom* by **Michael Seery** who was guest co-editor of the special themed issue of *Chemistry Education Research and Practice* alluded to earlier. He described on-going research and practice in the implementation of ideas to reduce cognitive overload for students, ideas like the use of worked examples, wikis, jump-starting lectures, podcasting and screencasting. This gave a myriad of ideas for in-service actions that might motivate students in their studies of chemistry, and also ensure that teachers are responding to the appropriate use of technologies.

**Marie Walsh** and **Marilena Carnasciali** thanked the conference participants who had presented, listened, discussed and otherwise appreciated a very packed and informative programme.

Some posters were also on display throughout the day. These included:

*TEMI: Teaching Enquiry with Mysteries incorporated* Broggy, J., Childs, P.E., McCormack, O., McManus, B., O' Dwyer, A.

*Innovative learning and support for teachers in chemistry* Hana Bartková, Anna Mittnerová

*Learning Styles and Teaching in the Classroom* Josephine Treacy

*National Centre for Excellence in Mathematics & Science Teaching and Learning: Teacher support services* Michelle Starr

*Chemistry for Non-Specialists – An In-Service Training Course* Maria Sheehan & Claire McDonnell

*Professional Development Service for Teachers – an overview of in-service supports* Angela Gammell

*CHEMISTRY TEACHER TRAINING IN TURKEY* MURAT DEMIRBAŞ, MUSTAFA BAYRAKCI, NAZMIYE BAŞER

## Conference Evaluation

At the end of the conference the participants gave verbal evaluations that were positive about the organisation, venue and programme.

## Conclusions

The conference heard presentations from representatives of eleven different European countries. It was an opportunity to consolidate the work of the Chemistry is All Around Us Network Project. Furthermore, it allowed associate partners and experts from Ireland to meet the European partners. The presentations not only highlighted common issues but also described initiatives in some countries that are attempting to resolve problems with pre-service and in-service teacher training. It begs the question that given the commonalities in shortfalls and reforms should the education systems of Europe not have a more uniform and streamlined approach to training provision?

### **Appendix 1: Programme Committee**

Dr. Hana Bartkova, Institute of Chemical Technology, Prague, Czech Republic

Dr. Maria Maddalena Carnasciali, University of Genoa, Italy

Dr. Murat Demirbaş, Kırıkkale University Education Faculty, Turkey

Dr. Milena Koleva, Technical University of Gabrovo, Bulgaria

Dr. Dionysios Koulouglotis Technological Educational Institute (T.E.I.) of Ionian Islands, Greece

Dr. James Ring, Limerick Civic Trust, Limerick

Dr. David Sutton, Limerick Institute of Technology, Ireland

Marie Walsh, Limerick Institute of Technology, Ireland



## Appendix 2: List of Participants

Name	Organisation	Country
Alison Cullinane	National Centre for Excellence in Maths and Science Teaching and Learning	Ireland
Amanda Gardiner	Limerick Institute of Technology	Ireland
Ana Pereira	Instituto Politecnico Braganca	Portugal
Angela Gammell	St Joseph's Spanish Point	Ireland
Anne O'Dwyer	National Centre for Excellence in Maths and Science Teaching and Learning	Ireland
Beulah McManus	Chemistry Education Research Group Uni Limerick	Ireland
Brigid Corrigan	Teacher	Ireland
Ciara NiDhrisceal	Gaelcholaiste Luimnigh	Ireland
Claire McDonnell	Dublin Institute of Technology	Ireland
Cristina Gaitan Fuertes	CECE	Spain
David Sutton	Limerick Institute of Technology	Ireland
Dionysios Koulougliotis	TEI of Ionian Islands	Greece
Eilish Coleman	Cork Institute of Technology	Ireland
Eimear O'Connor	Limerick Institute of Technology	Ireland
Hana Bartkova	Institute of Chemical Technology Prague	Czech Republic
Josephine Treacy	Limerick Institute of Technology	Ireland
Julien Keutgen	INFOREF	Belgium
Juraj Dubrava	TRANSFER Slovenko	Slovakia
Ken Maddock	NUI Maynooth	Ireland
Lorenzo Martellini	PIXEL	Italy
Maeve Liston	Mary Immaculate College	Ireland
Magdalena Galaj	WSINF	Poland
Marcela Grecova	Institute of Chemical Technology Prague	Czech Republic
Maria Maddalena Carnasciali	University of Genoa	Italy
Marie Walsh	Limerick Institute of Technology	Ireland
Mark Glynn	Dublin City University	Ireland
Michael O'Connell	Limerick Institute of Technology	Ireland
Michael Seery	Dublin Institute of Technology	Ireland
Michelle McKeon Bennett	Limerick Institute of Technology	Ireland
Milena Koleva	Technical University Gabrovo	Bulgaria
Muireann Sheehan	National Centre for Excellence in Maths and Science Teaching and Learning	Ireland
Murat Demirbas	Kirikale University	Turkey
Mustafa Nayrakci	Sakaraya University	Turkey
Niamh Burke	Gaelcholaiste Luimnigh	Ireland
Olga Ferreira	Instituto Politecnico Braganca	Portugal
Peter Childs	Chemistry Education Research Group Uni Limerick	Ireland
Peter Jackson	PDST	Ireland
Sandra Hanley	IT Tralee	Ireland
Sarah Brady	Dublin City University	Ireland
Siobhan Curtin	Limerick Institute of Technology	Ireland

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Yvonne Doyle	Limerick Institute of Technology	Ireland
Zdenek Hrdlicka	Institute of Chemical Technology Prague	Czech Republic

### Appendix 3: Conference Programme

8.30 a.m. - 9.00a.m.	Registration
9 – 9.15 a.m.	Welcome Michelle McKeon Bennett Head of Dept. Applied Science Michael O'Connell, Vice-President Internationalisation
9.15 – 10.30 a.m.	<i>Shared Experiences in Chemistry Teacher Training in Europe</i>
	Initiatives in Chemistry Teacher Training in Italy: Significant Testimonials Maria Maddalena Carnasciali, Laura Ricco
	Pre-service Primary School Teachers Ideas in Chemistry Preparing and Retaining High Quality Chemistry Teachers in Greece Katerina Salta and Dionysios Koulougliotis
	Chemistry Teachers' Training in the Fédération Wallonie-Bruxelles (Belgium) Zlata Selak & Julien Keutgen
	Chemistry Teachers' Training in Slovakia Katarína Javorová
	In-service teacher training in Portugal: Objectives, organisation and impact on teacher's career O. Ferreira, A.I. Pereira, A. Silva, E. Afonso and M.F. Barreiro
	Teacher training in Turkey and an analysis of the recent status Murat Demirbaş, Mustafa Bayrakçı, Nazmiye Başer
10.30 – 11 a.m.	Coffee Break
11 – 12.30 p.m.	Chemistry Teachers' Training: Bulgaria Milena Kirova, Adriana Tafrova – Grigorova & Milena Koleva
	Science Teachers Training in Spain Antonio Jesús Torres Gil
	TEACHERS' TRAINING IN THE CZECH REPUBLIC II Marcela Grecová, Zdeněk Hrdlička, Veronika Popová
	Chemistry Teachers' Training in Poland Magdalena Galaj
	Initiatives in Chemistry Teacher Training in Ireland Marie Walsh
	LUNCH in HUNT Museum

1.30 – 3.30 p.m.	<i>Initiatives in Chemistry Teacher Training</i>
	An Overview of the Chemistry is all around us network project Maria Maddalena Carnasciali
	From SER to STL: translating science education research into science teaching and learning Peter E. Childs
	Pre-service Primary Teachers Ideas in Chemistry Maeve Liston
	Investigating and Addressing Chemistry Misconceptions in the Subject Matter Knowledge and Pedagogical Content Knowledge of Pre-service Science Teachers Muireann Sheehan & Peter E. Childs
	Applying Technology to enhance Chemistry Education Claire McDonnell
	Using Moodle for sustainable professional development for teachers Mark Glynn
3.30 – 3.45 p.m.	Coffee Break
3.45 – 4.45 p.m.	The use of Visual Aids for concrete learners: Facilitating understanding in Organic Chemistry

	O' Dwyer, A. & Childs, P.E.
	Developing and Implementing Teacher Education Programmes & Resources for teaching Chemistry. Sarah Brady, Odilla E. Finlayson, Deirdre McCabe, Paul van Kampen, James Lovatt, Eilish McLoughlin
	Technology Enhanced Learning in the Chemistry Classroom Michael Seery
Cancelled due to ill health	<del>Teacher Professional Development as a Process of Boundary Crossing between Communities of Practice Geraldine Mooney Simmie &amp; Manfred Lang</del>
4.45 p.m.	CLOSING REMARKS