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European Chemistry and Chemical Engineering Education Network

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Project information

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Executive Summary

This report is aimed at the European chemistry and chemical engineering community – teachers, researchers, professionals, students and potential students.
A network has been created from the fusion of two previously existing networks, the European Chemistry Thematic Network (ECTN) and the European Chemical Engineering Education Network (ECEEN). The new network, the European Chemistry and Chemical Engineering Education Network (EC2E2N) brings together 118 partners from 27 European countries. The network brings together within a single entity all actors in higher education in chemistry and chemical engineering in Europe. There are schools, universities, industries, national chemical societies, and accreditation bodies in this new network. The partners are mainly European universities but also include the European Association of Chemical and Molecular Sciences (EuCheMS), the European Federation of Chemical Industry (CEFIC), GlaxoSmithKline (a major pharmaceutical company) and ASIIN (a German accreditation agency). All these actors are collaborating in the development of a knowledge based economy, specifically in chemistry and chemical engineering. The project:
- will produce innovative products and processes, such as a virtual campus, quality labels for teacher training programmes, a Eurolecturer qualification, training tools for languages in specific areas (English, German, Spanish, French and Italian), and a training course for generic skills for third cycle students.
- will also help promote entrepreneurship by proposing a curriculum for entrepreneurial skills and developing the tools for a network of entrepreneurs.
- will facilitate the comparability of degree programmes, and hence mobility, across Europe by creating a common database of programmes across Europe, by proposing a common framework for chemistry teacher training, and developing the tools for European quality labels for these programmes.
- will increase the attractiveness of studies in chemistry and chemical engineering by analysing the sustainability and identifying examples of best practice amongst the activities carried out across Europe for that purpose. A number of student-centred activities, including specialised summer schools and contests, will enhance European scientific citizenship.
- will support innovative ICT-based products by developing a virtual campus, by producing on-line language courses for chemists and engineers, on-line materials for lecturer competences, and on-line tests on fundamentals and in specific areas at the interface of chemistry and chemical engineering in English, French, German, Spanish and Italian.
- will enhance the interaction between chemists and chemical engineers in academia, support programmes at the interface of these areas, and increase the employability of graduates in those fields.
The project management has set up 14 working groups to work on the different topics involved in this project.
To date, the project has produced two reports concerning the creation and structure of a virtual campus,[1,2] has completed a survey of lecturing competences for university chemistry lecturers across Europe,[3] and has held a Summer School on Conservation Science.[4] Many other results/products are in progress as can be seen on the project website at www.ec2e2n.net. Readers are invited to consult the working group pages

and the newsletters that are available on this website. Related work is also found on the website of the Association set up to provide a sustainable future for the results of this project, at www.ectn-assoc.org and www.echemtest.net.

References

(1) Innovative Methods of Teaching and Learning Chemistry in Higher Education, I. Eilks and W Byers Eds., RSC Publishing (2009), ISBN 978-1-84755-958-6

(2) N Faginas Lago et al, Lect. Notes in Comp. Science, 6019, 29-40 (2010).

(3) http://ectn-assoc.cpe.fr/network/ec2e2n/docs/WP08_ResultsStudyAboutUniversityTeachingStaffCourses.pdf

(4) http://www.intensiveschool.eu

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1. Project Objectives

The project partners are collaborating in the development of a knowledge-based economy, specifically in chemistry and chemical engineering. The project objectives are:

- to produce innovative products and processes, such as a virtual campus, quality labels for teacher training programmes, a Eurolecturer qualification, training tools for languages in specific areas (English, German, Spanish, French and Italian), and a training course for generic skills for third cycle students.
- to help promote entrepreneurship by proposing a curriculum for entrepreneurial skills and developing the tools for a network of entrepreneurs.
- to facilitate the comparability of degree programmes, and hence mobility, across Europe by creating a common database of programmes across Europe, by proposing a common framework for chemistry teacher training, and developing the tools for European quality labels for these programmes.
- to increase the attractiveness of studies in chemistry and chemical engineering by analysing the sustainability and identifying examples of best practice amongst the activities carried out across Europe for that purpose. A number of student-centred activities, including specialised summer schools and contests, will enhance European scientific citizenship.
- to support innovative ICT-based products by developing a virtual campus, by producing on-line language courses for chemists and engineers, on-line materials for lecturer competences, and on-line tests on fundamentals and in specific areas at the interface of chemistry and chemical engineering in English, French, German, Spanish and Italian.
- to enhance the interaction between chemists and chemical engineers in academia, support programmes at the interface of these areas, and increase the employability of graduates in those fields.

2. Project Approach

A management committee has been established to deal with project management, dissemination, quality assurance and the exploitation of project outcomes. The development work of the project is being carried out by 14 different working groups, comprising a leader, a co-leader, and varying numbers of other partners depending upon the particular group. Group membership is organised to provide a good geographical spread and the range of expertise required to complete the group's tasks. The working group leader is a member of the project management committee. He or she reports to this committee which meets two or three times a year. Each group works on their particular sub-project (work package), holding meetings as necessary and reporting to all members of the network at the annual meetings of all network partners. This provides an opportunity for all network members to contribute to and/or evaluate the activities and outcomes of all the working groups.

Activities of the project are reported on the project website and in the electronic newsletters issued by the project (a minimum of 5 newsletters per year).

The project is thus divided into 14 sub-projects, which will produce a total of 54 separate outputs. There is a vast range of activities in these different sub-projects, as can be seen in the next section.

The activities and outputs are monitored and evaluated by the Management Committee which meets two or three times per year, all the members of the network at annual meetings, and external evaluators who attend the annual meetings.

Two Associations exist (ECTN Association and ECEEN Association) to ensure that the outcomes of the project will be exploited in the years after the project funding has ended.

Dissemination is achieved through a project website, electronic newsletters sent to over 1000 people, and participation/presentations at national and international meetings. Presentations are also made at the General Assemblies and meetings of the European Association of Chemical and Molecular Science (EuCheMS), whose members are all the European National Chemical Societies, and the International Union of Pure and Applied Chemistry (IUPAC).

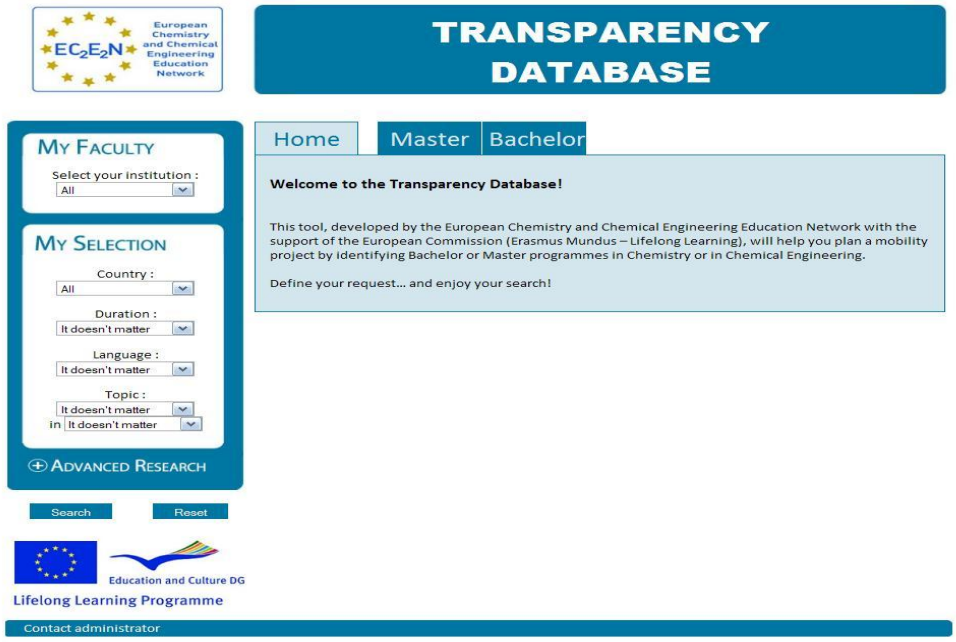
3. Project Outcomes & Results

At this mid-point stage of the project, most project outcomes are still in the development stage. The completed outcomes to date are:

- A project website at www.ec2e2n.net
- 6 newsletters, available on the project website
- A half-day seminar held at the 3rd European Congress, Nuremburg, DE on skills for chemistry lecturers (http://www.euchems-congress2010.org/scientific/sciother/edu.htm)
- A report on the features that a virtual campus for chemistry and chemical engineering teaching and learning materials should possess(1)
- A report on a scheme for distributed management of teaching and learning electronic materials (2)
- A survey of lecturing competences for university chemistry lecturers across Europe – the results are provided on the project website.
- A Summer School on Conservation Science attended by 52 students (http://www.intensiveschool.eu)
- A workshop on the chemistry and chemical engineering interface, see project website.

A number of results are nearly ready to be published. These include two modules of a course of English for chemists at http://ectn-assoc.cpe.fr/escs/default.htm , E-learning materials in conservation science, and programmes at the chemistry/chemical engineering interface.

The database of programmes in chemistry and chemical engineering in Europe is almost ready for publication on the Internet. The home page of this database is shown below:



Other project outcomes being developed are mentioned in the section on plans for the future (section 5).

References

(5) Innovative Methods of Teaching and Learning Chemistry in Higher Education, I. Eilks and W Byers Eds., RSC Publishing (2009), ISBN 978-1-84755-958-6

(6) N Faginas Lago et al, Lect. Notes in Comp. Science, 6019, 29-40 (2010).

4. Partnerships

In addition to around 100 university members from 27 European countries, the project partners include the European Association of Chemical and Molecular Sciences (EuCheMS), which includes all National Chemical Societies in Europe, the European Federation of Chemical Industry (CEFIC), and 11 National Chemical Societies. This means that all actors in the European chemistry and chemical engineering community are involved in this project.

In addition, the European Chemistry Thematic Network Association (ECTN Association), which was created to exploit and sustain the project outcomes, has become an Associated Organisation of the International Union of Pure and Applied Chemistry (IUPAC) and will attend their general assemblies. This gives the ECTN a high visibility in the worldwide chemistry community.

A partnership with other network projects in Science and Technology has also been formed, and an application has been made under the Erasmus Accompanying Measures action to hold a Forum in which the various network projects can disseminate their activities and discuss topics of common interest.

5. Plans for the Future

The next major activity of the project will be the annual plenary meeting which is being held in Bratislava, SK in May 2011. At this meeting all the working groups will have working sessions to present and discuss what has been achieved so far and to allow all project partners to participate in these discussions. There will also be plenary lectures on topics of relevance to the project, such as the higher education system in Australia, and the accreditation of chemistry programmes in the USA.

There will be a further plenary meeting in April 2012, in Milan, IT.

These meetings are attended by external evaluators so that we have feedback on the quality of our activities.

There will be meetings of the Management Committee to monitor and evaluate the working group activities in October 2011 (in Helsinki, FI), in February and in September 2012.

Two half-day seminars are being negotiated at major international conferences in Europe in 2012. We intend to participate in the 4th European Chemistry Congress, to be held in Prague in August 2012, at which over 2000 participants are expected, and in the IUPAC Conference to be held in Rome in July 2012 and at which one of the themes will be Chemistry Education for Citizens of the World. The activities fo this project will also be presented at the 4th Eurovariety in Chemistry Education Conference to be held in Bremen, De on 1 – 3 September 2011.

All working groups will prepare posters to illustrate their work. These can be presented at these, and other, major conferences.

Our plans for the electronic newsletter include having 11 issues in 2011 to mark the International Year of Chemistry. Each issue will have a guest editor. These editors have already been assigned, and are mainly national chemical societies.

The group working on the virtual campus workpackage will develop a model to provide the best way of collecting and sharing educational material (for example using agreed digital formats) and will complete the work started on proving a repository for this material. The repository will be open to all interested people and will be managed by the ECTN and ECEEN Associations after the end of the project.

The group concerned with stimulating entrepreneurship will start work in May 2012 when they will hold a workshop where presentations will be made by a representative of a university technology transfer department, by entrepreneurs who have established spin offs and by a representative of an entrepreneurship agency. This will lead to a report by the group showing approaches in different countries or at different universities and provide example of good practice. A survey of technological transfer activities in different countries will be carried out and recommendations developed concerning a curriculum for developing entrepreneurial skills.

The workpackage which deals with linguistic issues will complete the on-line course for learning and training in English for chemists and chemical engineers, adding a further module to the two already published. The previously developed courses on English for Special Purposes: Chemistry, are in the process of translation into French and Italian, this work will be completed during 2011. The English version of the chemical engineering internet-based test, being developed in the workpackage on

internet-based testing, will be translated into other languages as soon as the English version has been finalised.

The material (tests and courses) developed by this group will be tested on students in the partner universities.

Following the completion in February 2011 of a survey on lecturing competences for chemistry and chemical engineering higher education teaching staff across Europe, a framework offering teaching staff a European lecturing qualification will be created in 2011. This working group will also create a web-based course environment in order to provide self-paced study for the acquisition of lecturing competences. This will lead, in 2012, to the creation of a pilot European award for lecturing qualifications.

The sub-project on the employability of chemistry bachelors will complete the task of providing portraits of successful careers that started from a first-cycle degree and providing good practice examples of industry-academia cooperation. These tasks have been allocated to the group members and will be completed over the next twelve months.

There is a workpackage which is producing a database of chemistry and chemical engineering programmes across Europe. This data base will help students and teachers choose the most appropriate programme for themselves or their students. This will enhance student mobility in Europe and enhance the quality of this mobility by enabling students to choose the best course for their needs. At present there are 51 first-cycle and 61 second-cycle programmes on the database. The group will continue collecting programmes and these will be added to the database. The database is currently undergoing testing and the next stage will be to publish it on the Internet. The database will then be advertised and it will be tested by European students from member institutions. Discussions will also be held to choose the best editable forms of the database contents for the use of academics.

The workpackage involving the development of Internet-based tests in chemistry and chemical engineering will continue to add and up-date questions to the existing tests and refine and polish the test created in chemical engineering, in English. This latter test is expected to be ready in May 2011, and it will then be translated by project partners into several other languages. Questions for the database will also be produced by the group for topics at the interface of chemistry and chemical engineering.

The workpackage on the development of European quality labels for teacher education programmes has identified sources of information that will enable teacher training across Europe to be mapped. Based on the data collection, common goals, contents and activities as well as assessment procedures will be identified in a second meeting and incorporated into a fist document of promising European teacher education modules. This document will then be discussed and revised. In parallel, the exchange with the ECTN Association Label Committee should start to negotiate possibilities and procedures of labelling modules as “European Teacher Education Modules”.

As part of the activities of the International year of Chemistry, IYC 2011, this project is involved with two contests aimed at students of all levels, from 14 years old to undergraduates. The work in 2011 will be to advertise these contests, receive submissions from students via websites which have been created for this, and judge

them. One contest, the Global Stamp competition, is being held in collaboration with IUPAC with the support of our project partner GlaxoSmithKline:

See http://www.chemistry2011.org/participate/activities/show?id=110 for full details.

Two summer schools will be held in 2011, the first in Istanbul on 19-29 July 2011, on Chemistry and Cultural Heritage, in collaboration with Marmara University and the Turkish Cultural Foundation, and the second in Genova, Italy on 2-9 September 2011, on Conservation and Restoration of Metallic Materials, in collaboration with the Italian Metallurgy Society.

The group working on the topic of the attractiveness of chemistry and chemical engineering has published a questionnaire that has the objective of collecting information about activities throughout Europe undertaken with the aim at improving the public image and perception of both disciplines.

The group is now testing and evaluating different approaches to this goal, in terms of effectiveness and amount of effort required for implementation. This will lead to the development of a further questionnaire. Preliminary results will be presented by the group at the annual meeting of the project in Bratislava in May 2011.

The group working on improving learning outcomes in chemistry and chemical engineering are working on producing a booklet entitled 'Implementation of outcome-based education in chemistry and chemical engineering'. The content has been agreed:

Table of Contents

Introduction (4 pages)
Bologna
Employability
Outcome-based design
Learning outcomes (7 pages)
Definition
Graduate profile
Generic skills
How to write LO's
Examples of LO's at different levels
NB Programme LO´s should relate to graduate profile and module LO´s should relate to programme LO´s
Programme and course design (3 pages)
LO´s
Teaching strategies
Assessment
Conclusions (Challenges and advantages) (1 page)
Glossary

Some sections have been completed by working group members and other contributions be received over the next few months with the aim of issuing the booklet in September 2011.

The group dealing with generic skills in third cycle chemistry programmes will begin work with a meeting at the annual project meeting in Bratislava in May 2011. The group will report on the important generic skills for PhD students in chemistry and chemical engineering, drawing on the previous work carried out in the Tuning project, the EUA report of doctoral schools, and the 2008 Bologna Follow-up seminar entitled '3rd cycle degrees: competences and researcher career'.

Data will be collected concerning the current provision in different European countries for the acquisition of these generic skills, and a training programme will be developed. This programme will be piloted at a summer school in 2012. The programme will be disseminated as an example of good practice to universities throughout Europe.

There is a group looking at programmes at the chemistry and chemical engineering interface. The group has surveyed study plans that already exist. This has allowed them to have a present day vision of Chemistry and Chemical Engineering teaching in Europe. With this knowledge the group has put together several course guides for Chemical Technology and Engineering modules at different levels. These results will be published as a guide which describes different chemical technology and engineering courses that can be incorporated in European chemistry degrees.

Skills, competences and abilities that a graduate should have acquired in order to be suitable for employment in the chemical industry sector have been identified, and proposals have been put forward on how to guarantee that these elements are acquired by the future graduate during the educative formation cycles. Four key areas of action have been defined: degree structure, course design, teaching methodology and evaluation techniques. This work is being carried out in collaboration with the Employability working group (WP9) and with the CEFIC representative. The future task of the group is to design strategies via courses and activities that will lead to these competences and skills being acquired by the future graduate. This work will start at the meeting in Bratislava in May 2011.

In collaboration with the Improving Learning Outcomes working group (WP 15), a list of essential learning outcomes for a chemist in a first cycle degree related to chemical technology and/or engineering is being compiled.

The group is also going to design novel Problem Based Learning exercises and case studies that will give a chemistry student a chemical technology/engineering perspective. These will be published as examples of best practice at the chemistry/chemical engineering interface.

The final group, concerned with continuing education, will begin work in May 2011 at the Bratislava meeting this group will make suggestions of tools and/or procedures to promote the mobility of professionals and the Life Long Learning process. Use will be made of the outcomes from the workpackages on the database of chemistry and chemical engineering programmes (WP 10) and the Internet-based test development (WP 11). These products can be used, or adapted for use, for the evaluation of knowledge and competences and the recognition of prior learning and for identifying suitable programmes for a LLL educational programme. The tools will allow the diagnosis of needs for additional training/education and the design of an appropriate personal LLL programme (for example, identifying gaps in knowledge through testing and seeking a suitable programme or partial programme from the database).

6. Contribution to EU policies

The project addresses a number of the major EU policies involved in the realisation of a European area for lifelong learning and of development of the European Higher Education Area.
Two objectives of the Lifelong Learning Programme (LLP) are to promote employability and the growth of an entrepreneurial spirit. Two workpackages specifically relate to these objectives. The workpackage on the employability of graduate chemists will produce a series of portraits of the careers of bachelor chemists and examples of good practice of industry-university cooperation, and the workpackage on entrepreneurial skills which will produce recommendations for a curriculum for the acquisition of entrepreneurial skills and a report on best practices in the creation of spinoffs/start-ups.
Another objective of the LLP is to support the development of ICT-based tools for LLL. This is addressed by the workpackage which will develop the internet-based tests first created in a previous project. Tests in chemistry and chemical engineering will be further developed and translated into several languages from the initial English versions of the tests. Another workpackage has the objective to create a virtual campus for chemistry and chemical engineering learning objects. This will provide a centralised repository, giving students and teachers access to teaching and learning materials.
The quality of education and training in LLL will be enhanced by a study that is to be carried out on teacher training programmes for chemistry teachers, with the aim of providing a European framework for such programmes. The feasibility of creating a quality label to be awarded to those programmes that conform to the framework will be investigated.
The development of the EHEA will be aided by the creation of a database of chemistry and chemical engineering programmes across Europe, constructed in such a way that students and teachers can analyse the learning outcomes of each programme providing considerable help in comparability of such programmes. A European framework offering lecturing qualifications to university teaching staff in chemistry will also be created. This will help improve the quality of chemistry higher education.
A workpackage is also concerned with generic competences in the third cycle and how present programmes provide these competences. The group will create a programme to help with the acquisition of those skills identified as being the most important.

7. Extra Heading/Section

The project is supported by two Associations created to provide sustainability and to ensure exploitation of the project outcomes after the project funding period is over. These Associations, the European Chemistry Thematic Network Association, created in 2004, and the European Chemical Engineering Education Network Association, created in 2009, are solidly established within the European chemistry and chemical engineering communities, with well over 100 member institutions and based on a firm financial footing.