A Platform for sharing Expertise in University Chemistry and Chemical Engineering Teaching

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Introduction

Thematic networks were innovations of the EC’s Socrates-Erasmus programme that sought to provide a forum for the analysis and study of the state of development of education and training in Europe in order to improve quality over a European dimension. The Chemistry and Chemical Engineering Thematic Network (EC2E2N), formally the European Chemistry Thematic Network (ECTN) has been instrumental in developing and promoting a range of innovations relating to the teaching dimension of university activity over the past eighteen years. The Network, which currently consists of some 150 universities and professional societies, has been concerned not only with mapping and enhancing higher education and identifying good practice, but also in fostering collaboration and cooperation throughout Europe and promoting the development and production of European models. This has been achieved by supporting over 40 multinational working groups dealing with areas of specific interest and importance. Member organizations are widely distributed throughout Europe and also include a number of universities from countries outside Europe. It is clearly not possible to do justice to the range of activities undertaken in this article but details of all the Network’s projects, past and present, can be found on our web site (www.ec2e2n.net). Suffice it to say that a wealth of expertise on university teaching and learning is encompassed within the membership. The huge amount of available knowledge and experience in university chemistry teaching has been utilized in the working groups to produce a range of products, such as books and reports, and activities such as summer schools, etc. Such products and activities have been widely shared and disseminated to help improve the quality of university teaching throughout Europe. Products are open and freely available to all chemistry lecturers, though it is considered to be particularly important that new and inexperienced lecturers are encouraged and inspired to develop and innovate their teaching. However, it has been possible to share only a small fraction of the existing knowledge and precious experiences of the university chemistry and chemical engineering lecturers associated with the network at meetings of the working groups and the annual plenary meetings. There is clearly so much more knowledge and experience that could be shared. To facilitate this, an EC2E2N Working Group ‘Towards Excellence in School and University Teaching’ (www.ec2e2n.net/2/wp01), is currently compiling and developing a database of Expertise in Teaching of Chemistry in Higher Education.
The aim of the group is to collect knowledge and expertise on university education and to compile and connect it in a developing and growing network for the benefit of all university chemistry and chemical engineering teaching practitioners. The database will collect records of both:

(a) Profiles of individual university chemistry and chemical engineering educators (lecturers and other university teaching staff), which present details of their experience and areas of expertise in teaching and learning.
(b) Short descriptions of a range of topics related to the teaching and learning of chemistry and chemical engineering at university level. The descriptors will be linked to lecturers with relevant expertise, who are willing to answer questions, partake in discussions or even consider entering into advisory or cooperative arrangements.

Our overall aim is to create a knowledge-based platform on which information and people are functionally connected in a network that can grow and develop in a sustainable way. This will make it possible for lecturers to obtain information and take inspiration from the experiences of peers on how to design and develop high quality and sound teaching programmes.

Although the initial development has come from within EC2E2N all are welcome to join and be listed in the database. Please visit the Expertise in Chemistry Teaching – EC2E2N Database (http://starfish.innovatievooronderwijs.nl/information/77/), fill in your profile and request a Starfish account to contribute your teaching experience to this project (figure 1).

**Figure 1:** Expertise in Chemistry teaching – EC2E2N database on Starfish (http://starfish.innovatievooronderwijs.nl/information/77/, last visited August 31 2014)
Collection of brief descriptors on topics relevant to university teaching

The working group identified the 15 topics listed below for inclusion in the database:

1. Interactive Lecturing
2. Practical work
3. Group Work
4. Context Based Learning
5. Teaching with Technology
6. Research Based/Led/Focused/Informed Teaching
7. Work Based Learning
8. Tutorials
9. Assessment
10. Pedagogical Issues
11. Quality Assurance
12. Evidence-based Teaching Methods
13. Analogy-based Teaching
14. Learning Outcomes and Constructive Alignment
15. Supporting Learners.

Several topics were further divided into a number of sub-topics. For example, Interactive Lecturing has been divided into the seven topics: Incomplete Hand-outs, Questioning, Lecture Breaks, Audience Response Systems (Clickers), Flipped Lectures, Online Classrooms and Lecture Demonstrations. A total of some 52 sub-topics were identified and it was agreed that this would form the starting point for the database but other topics and sub-topics were likely to be identified and incorporated as work proceeds. Brief descriptors (approximately one side of A4) will be written for each of the topics and sub-topics. It is hoped that the database will initially serve two independent roles. Firstly the brief descriptors of topics related to teaching will provide an easy, first point of reference for new or experienced lecturers wishing to enhance or expand their teaching and secondly the database will provide details of individuals who have expertise in each of the topics described. This will enable universities or individual lecturers to identify appropriate individuals to consult for help, or invite to their institutions to promote appropriate improvements in teaching and learning. Further uses are likely to evolve as the number of records stored in the database increases.

Collection of profiles of university chemistry educators

The objective of the EC2E2N Working group Towards Excellence in School and University Teaching is to collect profiles for the network’s members and to inspire other lecturers to join and to use Starfish to provide and find information about quality teaching and learning. At the moment the number of profiles in the database is 35 but we hope to see this continue to rise towards 150 by the end of the current EC2E2N project.

Personal profiles in the database will all have the same structure (figure 2), although there is flexibility in how they are filled in. Each profile will consist of a photo and a short description of the teaching expertise, interests and affiliation of the individual. There will be a brief
description of the individual's core expertise and experience, in order to invite others to enter into relevant discussions or raise pertinent questions. An Email can be sent directly, and there is a button “Ask a question”. Using this button will result in the question being posted on the profile site where it may stimulate others to join in the discussion. In “See also”, all contributions of an individual to the database can be accessed. These will include descriptions of chemistry or chemical engineering teaching methods and also evidence and descriptions of good practices introduced through innovative approaches to teaching.

Most of the listed lecturers are also researchers and many of them maintain a personal homepage or have a homepage on their institution’s server, LinkedIn, or other social network. It makes no sense to duplicate these sites, and certainly not to increase required maintenance time, thus a profile listed in the database can be directly linked to such personal homepages (see Visit website, figure 2). Members who don't have a personal homepage can, instead, upload a cv into their profile. A short list of educational publications is welcomed in the profile.

![Figure 2: Personal profile of Iwona Maciejowska in the Expertise in Chemistry Teaching-Database (last visited August 21 2014) ](http://example.com/image.png)

**Design of the knowledge network Starfish**

The Expertise in Chemistry Teaching Database is situated in Starfish. Starfish uses a network approach to knowledge sharing where a large variety of entities can be connected according to the Technological Pedagogical Content Knowledge model or TPACK (Mishra & Koehler, 2006, figure 3). According to the TPACK model a lecturer needs to make use of knowledge
from three different categories: knowledge of content, knowledge of teaching methods (pedagogy) and knowledge of suitable educational technology, and integrate them to achieve quality teaching. The context of teaching is also important in determining how we teach and what we teach and must be considered when teaching is being designed. The TPACK framework, can be represented by a circle surrounding three overlapping circles at its centre (see figure 3).

Information about quality teaching and teaching design stored in the database of Expertise in Chemistry Teaching on Starfish can be searched from three different points of interest: from a pedagogical perspective, for example to obtain information about interactive lecturing (figure 4), good laboratory teaching or problem based teaching, from the perspective of content such as chemistry or more specifically what works in teaching analytical chemistry or chemical engineering and an educational technology perspective which can provide insight into information and communication technology (ICT) tools such as voting software or video conferencing facilities that can be used to enhance teaching and learning.

Figure 3: TPACK framework www.tpack.org

Figure 4: Information about Interactive Lecturing in the Expertise in Chemistry Teaching Database on Starfish is connected to different methods which can be used in the classroom through 'See also'.

After finding information from any specific perspective it is possible to go on to explore issues related to the other two perspectives linked through TPACK. For example one can explore which teaching methods are suitable to use when using a specific ICT tool such as voting software.

Teaching materials, themselves, are not specifically collected in either the database or on other parts of Starfish. However, we strongly encourage any lecturers who use databases of teaching materials to describe their experiences about how they use them in their teaching and to provide a link to such teaching materials databases. This will encourage others to make use of these materials.

Technically Starfish is not simply a classical database but is rather a network of knowledge. Each record described in the EC2E2N database on Starfish, whether it refers to a person or to a teaching method, is tagged according to at least one, most commonly two and sometimes all three of the constituent perspectives, content, pedagogy and technology, of the TPACK model. Using these tags and explicit algorithm-based links, added by humans, a network emerges that can be entered from any location and continue to be explored from there. This helps users to find information within the educational network structure in different ways depending on their needs and interests at any given moment.

Content on Starfish is community-driven relying on a combination of technology and the wisdom of contributors to maintain and improve its quality. Starfish aspires to be of use to university lecturers from different institutions all over the world. Some information is likely to be of interest to few individuals, while other information may well be relevant to a vast network spreading across many institution and countries. Sub-communities are therefore supported to share and explore material within small portions of the knowledge network. To facilitate rapid access to specific material created within the Network or any other community on Starfish in which you are involved it is possible to log in with your account which is connected to your personal profile.

Starfish is a network to enable people to share their expertise. It is open source and open content, and all are welcome to visit the Expertise in Chemistry Teaching – EC2E2N Database on Starfish. Please support your Network by submitting your own teaching expertise profile and contribute your knowledge and experience to this exciting project.

Visit Expertise in Chemistry Teaching – EC2E2N Database and get your account at:
http://starfish.innovatievooronderwijs.nl/information/77/