Newly Appointed University Chemistry Teaching Staff

Second Summer School
Malta
12-16 June 2007
PROCEEDINGS

European Chemistry Thematic Network

Newly Appointed University Chemistry Teaching Staff

Proceedings of Second Summer School

Contents

Introduction

We are always being encouraged to reflect, as academics involved in learning and teaching. It is not always possible to put this reflection into practice though, and I was delighted to have a second opportunity to do this by leading the second summer school for newly appointed university chemistry teaching staff. This was run thanks to a successful funding bid by the European Chemistry Thematic Network, and I would like to thank the Network's leaders for the confidence they placed in myself and my colleagues after running the first such summer school in Malta in 2005.

Obviously a few changes were made on this occasion; all sessions were run in workshop format, and participants were given a little more chance to relax between sessions. Many were undaunted by the fact that the hotel swimming pool was closed, and made good use of the nearby facilities of the Mediterranean instead. It was also encouraging that the second school drew a larger pool of applicants, although the task of selecting thirty proved to be quite difficult.

As previously, participants were asked to write a section of the proceedings with a colleague from a different part of Europe. On this occasion, they have also been asked to relate the contents of the workshop on which they have reported to the situation in their own countries. The proceedings that follow will hopefully provide a window on the current state of learning and teaching in higher education chemistry within Europe , as well as giving a flavour of the sessions that ran in Malta. I would like to thank all the writers for their contributions, and for being such a great group of people to work with.

Finally, I would also like to thank all my experienced colleagues who gave up their time to run sessions at the summer school. I know that a great deal of work went into this, and it was much appreciated by myself and the participants. I would also add that I know I learned a great deal from sitting in on these sessions, and I am sure others did too.

Paul Yates
Keele, United Kingdom
January 2008

Icebreaker and Evening Introduction

Leaders:
Tina Overton, University of Hull, United Kingdom
Paul Yates, Keele University, United Kingdom
Reporters:
Sébastien Gagneur, CPE Lyon, France
Dorota Majda, Jagiellonian University, Krakow, Poland

The aim of the first session of the ECTN Newly Appointed University Chemistry Teaching Staff Second Residential Summer School was to help the participants to get to know each other and to develop a pleasant and friendly atmosphere. This was done by a series of short interactive activities:

1. Within a few minutes each participant had to find out who was sitting next to her / him and afterwards had to introduce that person to the audience.
2. Each participant had to find somebody who owned a dog, could play a musical instrument, had ever been to Malta before, etc…
3. Participants were divided into five groups and using a newspaper, 30 cm of string and the same length of sticky tape, each group had to build as high a tower as possible. It had to be free standing!

Using the "snow-ball" technique the participants exchanged their views in terms of what they expected from the summer school and agreed on the following expectations:

- Share teaching experiences.
- Learn about non traditional methods to improve teaching and learning processes.
- Learn about different teaching styles to improve efficiency.
- Share information about curriculum development.
- Learn about how to create a positive atmosphere in the classroom.

Evening discussion

During the evening discussion participants shared sources of information on teaching in higher education and positive teaching experiences and teaching tips.

Sources of information on teaching in HE:

- ECTN, European Chemistry Thematic Network. 4th programme (3 years). Network of 150 HEI departments of chemistry. Activities:
  - Annual meetings
  - Working groups (about 30) including particularly the NAUCTS, EChemTest and Bologna declaration impact / Eurobachelor label.

- EuCheMS
  European Association of Chemical and Molecular Sciences Activities: there are divisions for every aspect of chemistry:
  - Chemical education
  - Analytical chemistry education
  - …

  Note: on the website there is a guide to giving a presentation at a European conference.

- The Higher Education Academy – Physical Sciences Centre. This organisation provided the participants with sample issues of their journals related to higher education.

- Journals:
  - EuroChem Education Journal

- MERLOT (Multimedia Educational Resource for Learning and Online Teaching)
- ACS
- JChemEd (Journal of Chemical Education)
- …

- International conferences:
- ICCE 2008 in Mauritius (International Conference on Chemical Education)
- …

Teaching ideas from participants' experience:

- Collect questions from students during the lecture via mobile phone SMS messages.

- Ask the students at the end of the lecture what they gained from it.

- Ask the students to fill out a questionnaire / feedback on what they thought about the course.

- Break the big groups in groups of 4 and let them teach each other, discuss exercises …

- Organise tutorials in small groups for students having difficulties and send them to the blackboard to solve exercises. Discuss mistakes with the students. Especially in organic chemistry where writing / drawing correctly is crucial.

- Ask the students to write the procedure themselves before starting the lab (check it before they put anything into practice of course…).

- Have the students and the professors list new skills learned during the day.

- After the lab sessions, organise oral examinations with the lab supervisor.

- Do not give fully written handouts: give only "appetizers". Give more oral explanations, look for interaction with the students, include practical work.

Survival for New Lecturers

Leaders:
Anna Maria Lilienkampf, University of Helskinki, Finland
Constantinos Athanasspoulos, University of Patras, Greece

Reporters:
A. González Vives, University of the Basque Country, San Sebastian, Spain
K Baltakys, Kaunas University of Technology, Lithuania

Annamaria Lilienkampf and Constantinos Athanasspoulos discussed the attitudes and activities that facilitate high quality teaching by new lecturers. They gave a brief introduction to their university and experiences, and the reflections of award winning first year teachers by talking candidly about their successes and setbacks.

There are natural differences between people and this can affect the way different students prefer to learn and the different style adopted by different lecturers. Every teacher develops their own style, structure and technique on the way to becoming as effective teacher. However there are a number of qualities common to all good teachers:

- development of teaching skills and methods.
- knowledge of the subject and of how students come to understand it.
- developing a view of oneself as a teacher and the teaching process.
- understanding how students learn in their subject and how they can best encourage learning.
- consideration of the students' responses to all teaching activities.

The last two points are especially important and play a major role in developing courses, classes and the forms of assessment used.

The lecturer should always consider the most appropriate teaching and assessment methods to enable their students to adopt approaches to learning which will lead to the understanding of their subject, not simply the ability to recall for assessment purposes.

An effective lecturer should aim to maximise the potential for student learning while stimulating motivation, giving students the opportunity and time to reflect on their beliefs and attitudes and to encourage further enquires. Lectures should not be used to transmit information that the students can acquire, often more effectively, from reading their textbooks. Unfortunately, this is the way they are most often used.

During the session we discussed the following problems:

- Problems with working students. They often miss scheduled classes due to work commitment. In cases where this is a larger problem one may try to re-schedule classes. If the problem is limited to smaller numbers then private lessons can be offered.
- Problems with not having a standardised assessment procedure. Initially one needs to devise one's own marking guide.
- Having literature that is not in the native language.
- Problems with students cheating because there are no consequences.
- No value of teaching skills and this is reflected in the pay structure.

- No balance of research and teaching (teaching stops our research career!).

Students recognise good teaching

The characteristics of good teachers as seen by their students can be summarised under three headings as follows:

1. Their attitude towards students:
    - They want students to learn, and master the content.
    - They want students to develop critical thinking skills.
    - They display empathy.
    - They encourage student feedback.
    - They are approachable outside classes.
2. Personal qualities of these teachers:
    - Enthusiastic.
    - Open and relaxed.
    - Motivating.
    - Humorous.
3. Teaching skills and practices of good teachers:
    - Give clear explanations.
    - Good use of anecdotes / examples.
    - Simple language used.
    - Student participation encouraged.
    - Variety of media used.
    - Well prepared and organised classes.
    - Student views respected.
    - Class breaks are incorporated.
    - Not 'know it all's.
    - Course notes given out.
    - Material made relevant.
    - Take account of students' backgrounds.
    - Give relevant and timely feedback on students' work.

Learning is seen to be a challenging experience while being enjoyable and rewarding for the students involved. Everyone has preferred methods and styles of learning. It is not possible to reach the ideal of meeting the learning preferences of each student learner during a short period of teaching. If we seek to adapt our teaching and the content of the session to the students' needs then students are more likely to enjoy a successful class in which their learning is maximised.

Lectures continue to be one of the most commonly used teaching methods in higher education. An effective lecturer should aim to maximise the potential for student learning while stimulating motivation, giving students the opportunity and time to reflect on their beliefs and attitudes and to encourage further enquires. Lectures should not be used to transmit information that the students can acquire, often more effectively, from reading their textbooks. Unfortunately, this is the way they are most often used.

Suggestions for new lectures

You will probably feel anxious and nervous before your first lecture. However there are some practical steps you can take to ensure that you hit the ground running and with success.

- Arrive early to prepare the classroom and to get your bearings.
- Greet students as they arrive.
- Start the session formally.
- Introduce yourself to your students and ask them to introduce themselves to each other.
- Announce your office hours.
- Hand out subject syllabus or outline.
- Present an overview of the subject especially the potential benefits to students.
- Establish ground rules of good practice.
- Explain the layout of the subject textbook.
- Describe your plan for testing and grading. Explain how they can succeed.

- Solicit student questions and reactions.
- Give an assignment out to be completed by the following class, or conduct a brief quiz to gauge where students are.
- Review the main points and clarify if necessary.
- End the session by thanking the students for their attention.
- After the session note your accomplishments.

In both countries, Spain and Lithuania, the new lecturers, take part in programmes for recent education graduates. For example, in Spain the teachers have a course of "activities in science learning". We also compare experiences with a more experienced professor after each teaching session. In both cases we receive help from an assigned mentor. The mentor also meets with you us to discuss our development program and career needs and interests.

Pedagogy

Leader:
Bill Byers, University of Ulster, United Kingdom

Reporters:
Paul Peijzel, Utrecht University, The Netherlands
Agnieszka Wegrzyn, Jagiellonian University, Krakow, Poland

'Teaching, learning and what happens in between'.

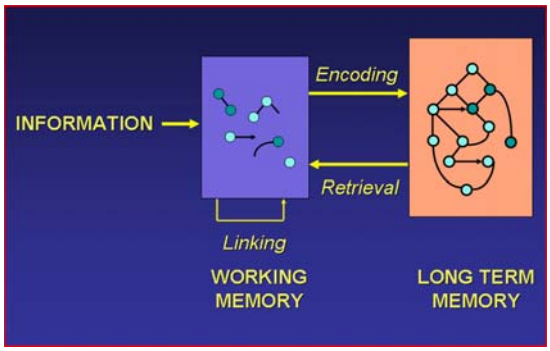
An important question on this matter is: why do we teach the way we teach? A possible answer would be: we tend to teach the way we do because of how we expect students to learn.

Although we hope others learn from our teaching, there is no direct relationship. Even if one could improve the teaching, this does not necessarily improve learning. So how do students learn?

The picture below shows a model of how information can be stored in one's memory. The teacher provides the student with information, which is stored in the working memory. The student then encodes the pieces of information and they are transferred to the long term memory to be retrieved when necessary.

There are two factors that influence learning: cognitive and affective learning.

Cognitive factors complicate the transfer of information. Not all incoming information will reach the working memory due to a so-



called perception filter. When focusing only on a certain aspect of the information (selective attention), some (important) pieces of information will be blocked. The limited capacity of the working memory allows only a certain amount of information to be stored at once. When information is transferred to the long-term memory, some pieces will be linked, while others will be stored separately. This transfer and storage can happen in different ways. To give some examples:

- With *rote memorising* the information is stored, but without links between the different pieces.
- *Misconception* occurs when the pieces of information are linked in the wrong way, giving incorrect interpretations.
- *Accommodation* is the process where stored information is modified to make the correct links between parts of it.

The **affective factors** determine the willingness of the student to learn. If he or she is not willing to learn, it really does not matter how hard we try. Three factors to be mentioned in this context are synergy, time and motivation.

Synergy is the situation where linking of information leads to more information. This may be achieved by starting a lecture with a question, learning by doing, and working in small groups in the laboratory.

It takes *time* to construct knowledge from stored information. Having open-ended problems, group work and oral/poster presentations are ways to encourage the amount of time spent on a task.

Motivation, if present, can be categorised in three forms:

- intrinsic motivation, where the student is interested in the subject itself
- extrinsic motivation, where the student is motivated because the learning will allow him to achieve something else (a skill or a mark)
- functional autonomy is the process that turns extrinsic into intrinsic motivation: 'what can I gain' instead of 'what do I have to do'.

Views from our own countries (The Netherlands and Poland):

One of the issues in both Poland and The Netherlands is that pedagogy and psychology courses are offered to undergraduate students, who want to become teachers. If you decide about your career later, which often is the case, you need to learn about teaching and learning basics on your own. Or you just try to teach the way you were taught and use your intuition, because there is simply no time to improve your teaching qualifications as you also have to be a researcher at the same time. Most of the time teachers are not confronted with the way they teach and rarely think about learning mechanisms.

A much more important issue is the organisation of the curriculum at university. In Poland some courses are obligatory, but students also have the possibility to choose **what** and **when** they want to learn. It is really difficult to arrange courses in a way that provides students with all the background knowledge they need at a particular level. If you teach more advanced students there is also a necessary compromise between the knowledge you expect from them in the beginning and what are they supposed to learn. The first thing is to determine what courses students have already finished as these are prerequisites to building new knowledge. As was already shown learning is more effective the more links between different pieces of information that can be established. Nevertheless, how many students choose courses that are too demanding? On the other hand there is no time to introduce all basic knowledge every time the new course begins.

In The Netherlands the situation is somewhat different, but it depends on the university. Bachelor students have a certain amount of freedom to use some of the time to take courses on optional subjects that may even be from a completely different direction. It is possible to study chemistry and take a course on biology or even law. There are prerequisites regarding the level of these courses. The same applies for the chemistry courses. It is usually not possible to take a high-level course without having passed the exam on the low-level course. On the other hand, as mentioned above, sometimes basic knowledge is just expected to be there and is not addressed in the lectures which may lead to students facing a course that is too demanding.

A new problem arises in Poland due to the fact that the number of students is larger every year. In this case it is more and more difficult to find a good way of including previous knowledge. It is also more difficult to work in small groups, because each of the students needs supervision. Individual presentations are very often unrealistic due to limited time and high cost. That is why (unfortunately) in academic courses memorising of several pieces of information is most common. The number of students of chemistry in The Netherlands is not too high (yet). In Utrecht the number has stabilised around 85 students. There is still enough time for individual attention towards students and group work can be in small groups (about 8 persons).

Issues raised by other delegates:

- Providing excellent lecture notes is not necessarily the best strategy, as it may create happy but lazy students.
- Students can get better when they receive proper support from the teacher (so-called scaffolding)
- Stress can be an important issue during exams. Start with an easy question and the student will do

Conclusion

In conclusion we can say that because there is no direct relationship between the quality of teaching and the quality of learning, it is important to assess both of them. In order to be as effective as possible in teaching, the affective factors should not be ignored as motivation may be the key to better learning.

Presentation Skills

Leader:
Paul Yates, Keele University, United Kingdom

Reporters:
Richard Henchman, University of Manchester, United Kingdom
Peter Weinberger, Vienna University of Technology, Austria

Given the fundamental role of communication in both teaching and research, three sessions were devoted to presentation skills. The first session covered planning a presentation, dealing with anxiety, preparation of visual aids, delivering a presentation, handling questions and reviewing presentations. In the second session the delegates divided into groups and each gave five minute presentations. Finally, delegates gave feedback on the presentations in the third session and compiled a list of presentation tips.

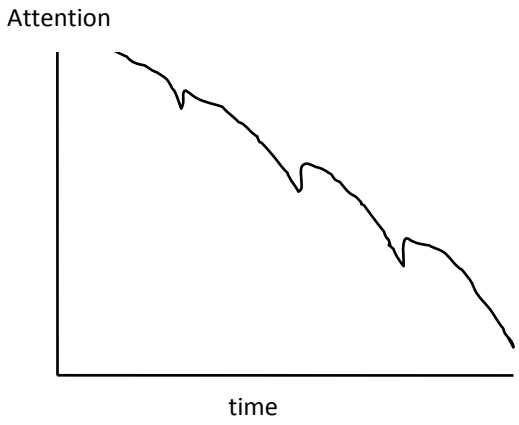
A number of important factors were considered in planning a presentation. First, particular features relevant to chemistry that should be addressed are the difficulty of discussing molecules too small to be seen and conveying abstract ideas such as forces. This necessitates a heavy use of visualisation, particularly in three dimensions, special symbols and equations, and demonstrations of experiments. Second, allowance should be made for the diverse range of audiences. In lectures students have various stages of education: mature students, refresher courses for working students and students from other disciplines (e.g. biology, medicine). That led us to the conclusion that no "one size fits all"! Third, the structure should contain an opening, main body and then conclusion, all of which should contain a take-away, memorable message, summarised as

1. Tell them what you are going to tell them.
2. Tell them.
3. Tell them what you have told them.

Having a good opening is very important since "You never get a second chance to get a wrong first impression right!" The length and content of the introduction differs between teaching and research presentations since students require basic knowledge and in-depth information while at a conference one has to justify why the research is being done. Having a strong, definite finish is also recommended so the audience is clear when you have finished. Fourthly, it is advisable to have some notes to avoid omitting material, even if familiar with it.

The next main focus of the seminar was on delivery, particularly to international audiences. Delivery should be slow, clear, with pauses and facing the audience with eye contact as much as possible. One should use simple language, explain new ideas and terms in different words supported by visual aids, keep jargon to a minimum, define acronyms, use international symbols and avoid humour since it might lead to cultural misunderstandings. It can be helpful to read the body language of the audience to gauge their interest. Leaning backwards, crossing hands or viewing somewhere else is a strong indicator of a non-attentive audience. Their attention span typically fades during the course of a presentation as depicted in the accompanying figure.

To get them back to you, do something unexpected such as taking a break, giving them something to do, or speeding up and



finishing in the case of a conference.

The other four aspects were considered in less detail. Anxiety is positive at a moderate level and encourages us to prepare and perform well whereas excessive anxiety needs to be managed by thorough preparation, practice, belief in the message, making no apologies and breathing and relaxing. Visual aids structure the talk, assist the audience, display technical information, serve as a prompt, provide a record and complement the message. While there is a range of visual aids to choose from, each part should contain one basic idea, a consistent and clear layout and colour scheme, minimal large-font text and plentiful graphics. Questions from the audience should be anticipated and practised. They should be answered in a relaxed and patient way. One can repeat the question, ask for clarification say if you do not know, or offer to answer after the talk. When reviewing, focus positively on what has been achieved, consider what could have been done differently, ask associates for constructive feedback and plan how to improve for next time. Viewing a taped video provides valuable additional feedback.

Two days after the first session, delegates each gave five minute presentations in small groups about a problem they had encountered in lecturing and how they overcome it. Problems encountered included the different abilities and interest levels of students, supporting learning with props or analogies, teaching maths, and engaging students at the start of a course. Delegates were then paired up to give detailed feedback on each other. The following day, additional feedback was given by the whole group to each presenter in turn and an overall list of tips was compiled for giving good presentations:

- Well-structured with a clear introduction emphasising the problem.
- Extensive use of graphics, using colours carefully.
- Prepare and practise.
- Speak slowly, clearly and loudly.
- Simple language and expression.
- Good eye contact with audience.

Despite the list of tips given above the personal experiences of Richard Henchman (native English speaker) and of Peter Weinberger (non-native English speaker) have been slightly different and can be summarized as follows:

Richard Henchman: The use of diction regarded as normal has to be critically reviewed since an international audience generally has a lower level of English language skills than anticipated. Therefore, it is of utmost importance to be attentive to the non-verbal reactions of the audience reflecting their ability to understand what you are telling. In future presentations I will pay specific attention to this kind of instant feedback and adjust my delivery appropriately.

Peter Weinberger: During the delivery of my own presentation I realised I might need to be better prepared with my visual aides to overcome language barriers. Especially when using a rather anecdotical style of presentation I tended to be too quick in speech due to my emotions. Thus a non-native English speaker in the audience may have lost track about what I am telling them just now. To circumvent this problem I need to be better prepared (I did not check that reasonable useful colour pens have been supplied with the flip-chart) using very clear visual aides and slow down my pace of the talk for future presentations.

E-Learning: A Practical View

Presenter:
Pita Vandevelde, Plantijn Hogeschool, Belgium

Reporters:
Sarah Howell, Keele University, United Kingdom.
Karolina Peckova, Charles University, Prague, Czech Republic.

E-learning can be defined in many ways but simply put it is electronic or technology based learning. It typically uses a learning management system, internet and e-mail to support learners in their learning, and allows them to do this at their own pace and in their own space. The two-hour lecture of Pita Vandevelde at the Summer School covered mainly three different aspects concerning e-learning:

1. Origin and driving forces of e-learning development;
2. Teacher-students interactions and discussion boards,
3. Self-testing and self-study.

Pita based her lecture at her own experience from Plantijn Hogeschool.

One of the driving forces for increasing e-learning is large class sizes and decreasing staff numbers and/or contact hours with students. The need arises to provide a medium by which students can take responsibility for their own learning by carrying out self-study. Three areas of e-learning were considered. First, a learning management system, such as Blackboard, allows the online material to be managed and delivered to learners. Blackboard allows courses and modules to be organised into separate spaces which only students enrolled on that particular course/module can access. A number of functions such as announcements, discussion boards, grade books, assessments, web links and calendars can be used and it is a place for students to access course material such as lecture overheads.

The second area covered was discussion boards, a topic which appeared to be of great interest to the group. Some of the participants appeared to have tried discussion boards in the past to different degrees of success and were interested in suggestions on how to encourage participation by students. Discussion boards were considered particularly useful for large class sizes where a lecturer may not have time to reply to the students individually, often needing to answer the same questions. Pita's approach was to set up discussion boards where questions can be posed by the lecturer or students and the students in the class answer the questions. As a lecturer she does not provide any answers, only confirming when the correctly answer is reached. In order for a successful discussion to take place everyone must be encouraged to become involved and the lecturer must also be seen to be involved. Also, material can be covered in the discussion board which is required by the students but not covered elsewhere. In order to facilitate discussions on chemistry topics special software may be required to allow objects such as mathematical equations or chemical structures to be represented.

The final area was the use of self-testing and self-study. This requires a large number of exercises to be automated. Students could test themselves on particular areas of chemistry and receive instant feedback in the form of a mark, correct answer and additional readings relevant to the areas they struggle with. Students are in control of their own learning and direct themselves through the areas they need the most help on. A number of software packages exist in order to aid in the design of suitable activities for students.

The use of e-learning in the United Kingdom is prevalent, although the extent of its use is dependent on the university, department and even individual. At one extreme the Open University relies heavily (although not exclusively) on e-learning for the delivery of learning materials and activities to distance students. In the chemistry and forensics

departments at Keele University (UK) the learning management system employed is WebCT, which has similar features to Blackboard. As a minimum, most lecturers place lecture notes and course documentation on the website. Many use additional features of WebCT such as: announcements, calendar, web links, assignment submission/grading/feedback and plagiarism detection with 'turn it in' software. Discussion boards are primarily used for feedback on courses so students are able to add their comments anonymously and where appropriate a lecturer will respond, although often higher level students will respond as they experienced the same difficulty themselves. One very specific use of discussion boards presented by Pita was for mentoring group projects. Such use of a discussion board may be useful for the final year forensic science projects. Groups of four students are given a project under the supervision of a lecturer. A discussion board exclusively involving the four students and their supervisor would allow the students to communicate with each other in order to organise meetings, plan laboratory work, share ideas etc and would also allow the supervisor to track the progress and participation of each of the students and allow feedback to the group, rather than replying to individual emails on topics which effect the whole group.

In the Czech Republic, the situation with e-learning is rather ambivalent and differs from university to university. In general, at technical universities the use of e-learning platforms is more developed than at other universities. At the Technical University in Brno the LMS MOODLE is used, mostly for the placement of study materials to lectures or for pre-lab preparation and testing. The Charles University in Prague uses the same platform; however, the existence of it is latent to many of the faculty academic teaching staff. At chemistry departments, the most active one is the Department of teaching and didactics of chemistry, which runs some e-courses for its students, some of them also open to general public. However, most of the teachers have public web pages for posting of study materials and the university also runs a developed study information system, where basic information on all courses, lectures and seminars are given. This system also gives the teacher easy e-mail communication with students subscribed to a concrete subject and provides students with the opportunity to give feedback on it. The partially limiting factor of using e-learning in Czech Republic still seems to be the access to computers and internet, which may not be easily available at some universities and student campuses. The interested teachers struggle for development of e-materials for distance and other students, which could also fill in the sometimes missing study materials in the Czech language.

The discussions on e-learning during Pita's lecture and continuing throughout the whole Summer School revealed big differences in e-learning development at different universities, even within one country. This provides evidence that the personal interest and needs of particular teachers in this field could be the driving force for e-learning development, especially at universities having less experience in this field.

Blended Learning

Leader:
Hazel Wilkins, Robert Gordon University, Aberdeen, United Kingdom

Reporters:
João Belo, Castelo Branco Polytechnic Institute, Portugal
Nicole Pamme, University of Hull, United Kingdom

Summary

Blended Learning is a mixture of distance learning (online, or paper based) and face-to-face teaching. Such mixing of different teaching methods it is often found to lead to a better learning experience. Blended learning is an excellent tool to make students more responsible for their own learning, to move them away from the "spoon feeding" of education to planning and controlling their own learning.

Computers and Information and Communication Technology are now an integral part of students' lives and are thus good media to start off this process of independent learning. However, often students are initially rather reluctant to be in charge of their own learning as there is an expectation of wanting to be taught and to be told exactly what to do. For these students, blended learning might initially be a somewhat difficult experience that will require patience and careful guidance from the lecturer.

To implement Blended Learning, the Robert Gordon University (RGU) in Aberdeen developed its own internal Virtual Learning Environment called the Virtual Campus (VC) shortly to be replaced by Moodle. The VC e-learning platform provides a comprehensive infrastructure for learning and flexibility for the students to study in their own time, 24 hours a day, 7 days a week.

At RGU the VC supports two distinct types of students: full-time students (on-campus); distance learning and/or part-time students (off-campus). For the full-time students (on-campus), the e-learning platform is mostly used for posting of core material for courses such as lecture material and tutorial worksheets. Students can download these and read the material prior to the lecture for preparation. Another important feature is the availability of sample assessment questions in VC. The distance learning and/or part-time students (off-campus) also benefit strongly from the VC, as it provides them with many of the facilities normally found on a traditional university campus, such as library access and on-line resources, discussion groups and teamwork areas. A distance learning course that is largely based on the use of the VC platform has been created (the Diploma in Higher Education in Applied Chemistry) and has replaced a former day-release course.

Analysis on usefulness in own country

João Belo: The use of Blended Learning also called B-learning is widely spread in Portugal at the University level and at secondary schools. The Portuguese Government helped by creating a national network (eU) which allows the students and teachers to access the internet with wireless LAN on all University campuses in Portugal.

Since then students and teachers have been involved in a kind of "vicious circle": when a teacher creates B-learning material, the students begin to ask for more material, and the teacher can demand a larger involvement in the learning process from the student. In my particular case I have developed a number of tasks in B-learning and now my biggest difficulty it the dependence on others (Informatics engineer) in the creation and spreading of my material.

Nicole Pamme: Prior to the workshop I was unfamiliar with the term "blended learning". However, I am aware that such a mixture teaching methods, including on-line material

and on-line self-testing as well as problem based tasks for part time students already exist within my department. I have so far been somewhat reluctant to provide course material on the internet, as I have considered this as too much of a "spoon feeding" of the students. However, based on the workshop I have learned that, if done with thought, blended approaches can work well; and I will take a fresh look at this attitude.

Pre-Labs

Leader:
Hazel Wilkins, Robert Gordon University, Aberdeen, United Kingdom

Reporters:
João Belo, Castelo Branco Polytechnic Institute, Portugal
Nicole Pamme, University of Hull, United Kingdom

Summary

Laboratory classes often have a wide range of learning objectives including an understanding of theory and calculus, an improvement of manual skills and time management, as well as the capability to collect and interpret data. As a result, students are often overloaded. Furthermore, it is often found that students come to classes totally unprepared. Hence, they are often found to follow lab manual procedures without understanding the context of the experiment and thus without learning anything.

Some form of pre-laboratory class exercise (pre-labs) can be beneficial in such circumstances. Students are forced to engage with the material before the lab, so they know what they are doing and why.

Pre-labs can come in the form of short questions, sample calculation or quizzes. Students could be asked to draw a flow chart of the experimental procedure or to look up health and safety regulations for the chemicals. Some form of assessment must be included to ensure that students do the pre-lab exercises and that they see the pre-labs as an integral part of whole practical assignment. When designing pre-labs it is important to keep the overall aim in mind, i.e. the students should read the material and gain a basic understanding of the lab class. Giving the students too much to do beforehand might be counterproductive and boring.

Analysis of usefulness in own country

João Belo: In Portugal pre-labs are a fundamental part of laboratory classes; they form part of a process used to increase the responsibility of the students for their own work, and to prepare them for situations in which they will take complete responsibility.

In the first year a small amount of pre-lab work is given to the students; usually they are asked to perform simple calculations, search for some safety measures and given a bibliography to support the practical work. In the following years the amount of pre-lab work increases, with the intention to help the students to become more independent and to be fully conscious of the work they have to perform in the laboratory. In the final year, students are expected to prepare themselves independently for a laboratory task, based on the work title and objectives.

Nicole Pamme : Pre-labs are not currently used in the analytical chemistry teaching labs. From my own experience I have often found that students come unprepared. I am aware that pre-labs are used for other chemistry lab-classes and that colleagues have had good experiences with them. Encouraged by the summer school, I have now raised the issue with colleagues within my section and hopefully we will be able to include some form of pre-lab exercises in the coming academic year.

Practical Classes

Leader:
Stuart Bennett, Open University, United Kingdom

Reporters:
Michael Seery, Dublin Institute of Technology, Ireland
Milen Bogdanov, University of Sofia, Bulgaria

The Chemistry Practical Classes session was delivered by Stuart Bennett, a senior lecturer in chemistry at the Open University, UK whose research interests include looking at the role of practical work (Bennett, 2000). The aim of the session was to investigate what is practical work and to examine whether practical classes carried out in universities were really experimental in nature, and to reflect on whether practical work, with all of its associated costs, needed to be changed or adapted to enhance the student learning experience. The session tied in with other sessions on assessment, pre-Labs and group work.

The workshop started with an exploration of the differences between a practical experiment and a practical exercise. The group discussed their experiences, and concluded that many students who complete practical work are doing exercises, in that they are verifying a known fact (the "formal" practical category, (Kirschner and Meester, 1988)) or following a given procedure (the "investigatory skills" practical category). Stuart presented some data of an analysis of 1st year undergraduate practicals in English Universities which found that 90% of practicals fall into these practical *exercise* categories. Experimental practicals (open-ended and divergent categories) were very much in the minority.

There was some discussion about what the role of practical work was. Some participants felt that students gained some experience in instrumentation or procedures by doing practical exercises. This was generally agreed, although there was a feeling that a greater role of experimental work was desirable in that they are more interesting to do, require a greater range of skills and better reflect the range of skills the student would require after graduation.

The group was asked to provide a list of what skills students would learn from practical work. As well as the manipulation and data management skills, a range of other transferable skills such as problem solving, team work and communication were suggested. With these in mind, and the fact that fewer than half of chemistry graduates go on to a chemistry-based career, Stuart presented an alternative to the practical exercises that are prevalent in universities. This alternative approach is based around presenting students with a problem (usually context-based). The students are required to develop an experimental strategy based on equipment and time available, and using their previous experience, discussion with colleagues and investigation of texts/literature. The students can then complete the laboratory work, analyse the data and draw their conclusions. A second important change is a student critique of their work, whereby they examine their approach and resolution of their problem. The principal changes in this alternative approach to delivering practical classes are that the students generate their own approach to the lab and they critique their work afterwards. It is within these changes that transferable skills such as group work, problem-solving, communication and reflection are used. Stuart argued that the outcome of this approach is that although the students spend less time in the laboratory, the time they do spend there is more productive. In addition, the students are more interested and motivated as they have ownership of the work, they are more critical of their work and transferable skills such as team work are developed.

In the Irish context, the nature of practical classes is very much exercise-based. However, there are some changes happening slowly. Here in DIT we have implemented some experimental classes with a lot of success. The positives are that students are much more motivated by the experience, and hence are more engaged in the work (McDonnell et al, 2007). In terms of the wider implementation of these classes, issues such as class size and changing the mindset of other staff need to be addressed. There is an increasing demand from students however to make what they study more "relevant", so this may have a positive impact.

In Bulgaria, the practical classes in basic courses (organic, inorganic and analytical chemistry) are "traditional", namely the students just follow the instructions and thus gain some experimental experiences. In advanced courses (Master programmes) the practical classes are open-ended and the students have an opportunity to solve a given problem by themselves. They have to explore different solutions and to argue for the method which they have preferred for their further experimental work. The last give them more independence to achieve analytical thinking and to make deductions. In conclusion the "traditional" practical classes are presented in the basic courses, whereas the "alternative" practical work is applied in advanced courses.

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Context and Problem Based Learning

Leader:
Tina Overton, University of Hull, United Kingdom

Reporters:
Lindsey Munro, University of Manchester Metropolitan, United Kingdom
Stela Georgieva, University of Chemical Technology and Metallurgy, Sofia, Bulgaria

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The chemistry graduate requires not only a solid knowledge base but also the ability to apply and extend their knowledge in order to solve unfamiliar problems. Analytical and critical thinking skills are assumed and, in addition, communication, team working, time management, independent learning skills and, last but not least, enthusiasm. The context and problem based learning session aimed to help the summer school participants use real world problems to motivate students to identify and apply research concepts, work collaboratively and communicate effectively.

What is Context-based Learning (CBL)?

In **C**BL, learning is organised around real life scenarios. The educational philosophy of the teacher, learning needs of the students and availability of resources can significantly influence the feasibility of using this mode of learning.

What is Problem-based Learning (PBL)?

How can I get my students to think? - A question asked by many faculties, regardless of their disciplines. PBL is an instructional method that challenges students to “learn to learn”, working cooperatively in groups to seek solution to real world problems. It is a subset of the CBL approach. The problems serve as the context for new learning and they are encountered before all relevant knowledge has been acquired. These problems are used to engage students’ curiosity and initiate learning the subject matter. The learner discovers a combination of previously learned and new rules that he/she can apply to achieve a solution. PBL prepares him/her to think critically and analytically, and to find and use appropriate learning resources.

PBL is any learning environment in which the problem drives the learning. The main factors that play a role in PBL are:

- ***Curricula organized around problem scenarios and problem solving* -** Posing the problem before students are taught a topic tends to motivate students. Learning in the context of the need-to-solve-a-problem also tends to store the knowledge in memory patterns that facilitate later recall for solving problems. Hence, the subject knowledge is learned in formats different from the traditional subject-based format. Since problem-based learning starts with a problem to be solved, students working in a PBL environment should be skilled in problem solving and "thinking on your feet" (as opposed to rote recall). The problems should be real and engaging, require a problem solving strategy and acquire new knowledge. In addition, it requires students to deal with uncertainty, which is a critical skill for the flexibility a graduate must demonstrate in the workplace. This learning environment is active, cooperative, self-assessed, provides prompt feedback, allows a better

opportunity to account for personal learning preferences and is highly effective.

- After finishing a task, the learners may assess themselves and each other to develop skills in self-assessment and the constructive assessment of peers. These skills are essential for effective independent learning.
- Research shows that PBL students perform as well as or slightly worse than students from traditional courses on conventional examinations of knowledge due to their smaller knowledge base. However, PBL students are superior with respect to
    - approach to study and learning.
    - long-term retention of knowledge.
    - use of resources.
    - developed key skills.
    - success as postgraduates.
    - Motivation.

Challenges

Lecturers need to check what conceptions students bring to their chemistry learning and to set up opportunities for these to be discussed and challenged as necessary. It has to be recognized that this is a time consuming process. It will depend on questioning, discussion, group work and time allowed for learners to "play with ideas". In the long run, this time will be well spent but it does demand a content reduction.

Practical Exercise

This type of approach was clearly illustrated during the group task we attempted at the summer school in order to discover what event had occurred around the River Dribble leading to illness and destruction. Information was distributed on clue cards given to each person. The tendency was to break off into small groups to try to solve the problem. However, after half an hour, the problem was still not solved and the solution revealed some facts that were unknown to many of the group. In general this task would be run for an hour – but it clearly highlighted the necessity for the group to work as a whole. Success is best achieved if each person reads aloud their clue to the whole group and then everyone can solve the problem. It certainly would help develop confidence, team work and communication skills – as well as training students to pick out relevant details from a multitude of information.

Examples of Problem-based Learning:

The following case studies were developed at the summer school:

- **solving last night's hangover**
  - Find structure of suitable cures
  - Find synthetic pathways
  - Estimate scale of production
  - Design the process
  - Safety aspects

  Assess: Presentation of results.

- **criminal inspection**
  - Details of car crash given
  - Students must find the cause
    - Find how to calculate/do:
      extraction & analysis of blood
      ethanol content of blood
      NMR/IR/GC-MS on blood

    Assess: Witness Statement Report.

- **New Sunscreen**
  - Compare a range of sunscreens
  - How effective is it?
    (UV adsorption etc…)
  - How toxic is it? (literature search)

  Assess: Report suitable for a journalist (based on scientific evidence).

- **Household Detergents**
  - Compare traditional vs eco-friendly
  - Find formulation.
  - How does it work?
  - Environmental control?
  - Toxicology?

  Assess: Scientific-based advert

- **Aldol Condensation Reaction**
  - Find ingredients
  - Find lab synthesis mechanism
  - Carry out practical

  Assess: Report

Problem-based learning in the analytical chemistry laboratory course - Bulgaria

The problem-based learning (PBL) approach addresses many of the limitations of traditional methods by teaching important concepts in the context of solving real analytical chemistry problems. In the context of solving a problem, students may have to consider issues such as obtaining a representative sample, how to properly prepare the sample for the analysis (most real samples are not soluble white powders), which method or methods are most suitable for the analysis, and how to identify and compensate for matrix effects. Statistical analysis of results is also an important component of PBL laboratory exercises, because students need to interpret their experimental results in the context of solving the problem at hand. The concepts of precision, accuracy, and confidence intervals take on new meaning when evaluated in the context of a real-world problem. Usually the students are split into small groups of eight to twelve students when the semester starts. Each analytical team is presented with a problem that they work together to solve over the course of the semester. Because the problems are fairly open-ended, the first challenge the students face is defining the problem. Before jumping into the laboratory, the analytical teams prepare proposals, complete with a detailed cost analysis, and describe their approach for attacking the problem in an oral presentation. The key to effective teaching using problem-based learning methods is to present the students with interesting and challenging problems. In addition to the preparation of the project proposal, the teams prepare an interim progress report, which is also summarized in an oral presentation. At the end of the semester, the work of each team is presented in the form of a written report, a scientific poster presentation, and oral presentation which is widely attended.

"Light-touch" Problem-based Learning- United Kingdom

During our latest curriculum review, "light-touch" elements were introduced into each of the core units at all levels. These deliberately have a lower lecture component and require the students to develop their independent learning skills to investigate a project in an unknown field. The assessment will be by a combination of posters, presentations and reports and will include an element of peer review.

In the 1st year General Chemistry Unit, we are replacing the current 10-week course on p-block chemistry with 4 weeks of lectures covering the key points (inert pair effect, Pauling acidity rules etc.) and edited highlights of the groups plus an investigative project into "The Chemistry of Everyday Materials". Most students have already been exposed to some aspects of p-block chemistry but not at the level of detail required at university. Thus, the topics are familiar and a little dull. In addition, students find the topic very factual and tend to memorise all permutations of compounds rather than focus on the key concepts and understanding their effects on each group.

The project will encourage (force) them to explore the role of p-block elements, applying the fundamentals that they have learned but also tackling novel topics. Examples include the role of selenium in photocopying or its carcinogenic properties. Each group of 5 students will pick a topic and develop their own plan for the areas they want to cover. Having presented their plan indicating both time management skills and an equal division of labour – both on content and presentation, the students have 4 weeks before a poster presentation session. The posters will be reviewed both by their peers and by an academic. The students will review the individual contributions to their group compared to their original plan, ensuring that the marks correctly reflect the individual effort. The aim is to ensure that the students take responsibility for their own learning, understand how their individual efforts lead to a useful final product. It also gives them the opportunity to learn through their peers.

Summary

In conclusion context- and problem-based learning approaches provide opportunities to integrate the application of knowledge, independent learning and problem solving with the development of professional skills and generate enthusiasm. As shown from the examples in Bulgaria and the UK, it is clear that these approaches are slowly being introduced into the traditional chemistry curriculum. Ultimately, they should ensure that a chemistry graduate could thrive in any situation in the real world.

Assessment

Leader:
Stuart Bennett, Open University, United Kingdom

Reporters:
Diana Cheshmedzhieva, University of Sofia, Bulgaria
Santiago Gomez-Ruiz, University of Rey Juan Carlos, Móstoles, Spain

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Dr Stuart Bennett from the Open University ran the workshop on assessment as part of the summer school for newly appointed university teaching staff in Malta.

"Why do we assess?" was the first very important question. To introduce his talk there was a short discussion and intuitively all the participants gave the common answer - to get feedback and to give a mark.

Stuart added more important motives to assess and generalized them as follows:

- To diagnose faults.
- To guide improvement.
- To provide feedback (as the delegates had discussed).
- To classify students.
- To inform employers.
- To motivate students.

The workshop was also concerned with learning outcomes, which are what we have to assess and which must coincide with what is taught to the students during the course. The learning outcomes should include the basic areas of knowledge and specify a cognitive, practical and transferable skill that needs to be acquired by our students. It is important not to forget that our discipline is not the only one they are studying.

Stuart paid attention to how difficult, how different and how many facts are taken into account when you assess. The quality and validity of assessment was also discussed. The workshop was centred on the validity, transparency, efficiency, manageability and fairness of the assessment, in order to reflect what the teacher wants and what the students needed to know. It is well known that the students want to know what will be assessed. According to this fact, from the point of view of the assessment in Spain and Bulgaria, the assessment method as well as the learning outcomes are normally described at the beginning of the semester or at the beginning of each block of the subject, in order to guide and motivate the students; in this way the assessment seems to be more fair for the students.

The workshop also dealt with assessment styles, because there are many different possible assessments. The different types of examination and assessment with their advantages and shortcomings were considered: traditional exams, open book exams, structured exams, essays, reviews, reports, practical work, portfolios, presentations, vivas, projects, posters, exhibitions and dissertations.

During the discussion in our buzz groups we were able to discover the way in which our colleagues examine and assess. The most common in all the countries are of course the traditional exams, reports, presentations, dissertation and practical works. In Spain the most common styles are the traditional exams, which actually are easier to assess than the non examination-based assessment. These assessments were also discussed and this highlighted the difficulty of running them fairly. In Bulgaria the exam is usually divided into two parts, the written and oral exam, but actually more and more lecturers prefer the multiple-choice test containing also some "open" questions.

Other topics covered were the mark schemes and feedback, which in some countries remained inaccessible to the students, for example in Bulgaria. However, in Spain it is compulsory for the teacher to explain before

the exam starts how the student will be evaluated and how many marks the student will obtain in each question. Stuart also introduced Bloom's taxonomy, which identifies six level of knowledge: knowledge, comprehension, application, analysis, synthesis and evaluation. On this basis he made an analysis of some type of questions from exams from different years. The conclusion was that the questions emphasize strongly the first level knowledge and are weak in terms of comprehension and application. This is the usual situation in Bulgaria and Spain.

Finally the workshop covered the "ten guidelines" described by Johnstone on the relationship between knowledge, comprehension, application, analysis, synthesis and evaluation:

- What is learned is controlled by what you know and understand.
- How you learn is controlled by how you learned in the past.
- If learning is to be meaningful, it has to be linked to existing knowledge and skills.
- The amount of material that can be processed in unit time is limited.
- Feedback and reassurance are necessary.
- Cognisance should be taken of learning styles and motivation.
- Students should consolidate learning by asking how they learn.
- Room for problem solving in its fullest sense.
- Room to create, defend, try out and hypothesise.
- Opportunity to teach.

Evaluation

Leader:
Paul Yates, Keele University, United Kingdom

Reporters:
Pawl Kozyra, Jagiellonian University, Krakow, Poland
Hassan Ali, Dublin Institute of Technology, Ireland

Evaluation is an important and yet often frustrating experience for both students and staff. Perhaps one of the biggest difficulties lies in the fact that it is difficult to be objective and comment on your performance when you are so involved in the mechanics of devising and performing your session.
Evaluation is a methodological area that involves the process of gaining feedback from a variety of sources, analysis and reflection on the information gained and the development of amended (or not) practice.
Probably the most frequently given definition is:
'Evaluation is the systematic assessment of the worth or merit of some object'
This definition is hardly perfect. There are many types of evaluations that do not *necessarily* result in an assessment of worth or merit - descriptive studies, implementation analyses, and formative evaluations, to name a few. Better perhaps is a definition that emphasizes the information-processing and feedback functions of evaluation. For instance, one might say:
'Evaluation is the systematic acquisition and assessment of information to provide useful feedback about some object'
Both definitions agree that evaluation is a *systematic* endeavor and both use the deliberately ambiguous term 'object' which could refer to a program, policy, technology, person, need, activity, and so on. The latter definition emphasizes *acquiring and assessing information* rather than *assessing worth or merit* because all evaluation work involves collecting and sifting through data, making judgments about the validity of the information and of inferences we derive from it, whether or not an assessment of worth or merit results.

The generic goal of most evaluations is to provide "useful feedback" to a variety of audiences including sponsors, donors, client-groups, administrators, staff, and other relevant constituencies. Most often, feedback is perceived as "useful" if it aids in decision-making. But the relationship between an evaluation and its impact is not a simple one - studies that seem critical sometimes fail to influence short-term decisions, and studies that initially seem to have no influence can have a delayed impact when more congenial conditions arise. Despite this, there is broad consensus that the major goal of evaluation should be to influence decision-making or policy formulation through the provision of empirically-driven feedback.

There are many different types of evaluations depending on the object being evaluated and the purpose of the evaluation. Perhaps the most important basic distinction in evaluation types is that between *formative* and *summative* evaluation. Formative evaluations strengthen or improve the object being evaluated -- they help form it by examining the delivery of the program or technology, the quality of its implementation, and the assessment of the organizational context, personnel, procedures, inputs, and so on. Summative evaluations, in contrast, examine the effects or outcomes of some object - they summarize it by describing what happens subsequent to delivery of the program or technology; assessing whether the object can be said to have caused the outcome; determining the overall impact of the causal factor beyond only the immediate

target outcomes; and, estimating the relative costs associated with the object

What ever the evaluation is, each type needs different sources of information. The main sources of such information will be either self assessment, student feedback, feedback from colleagues or external feedback? Each of those elements has other ways or sources of evaluation, for example student feedback can be achieved by questionnaire, metaplan, open discussion, snowballing or formal committees. However more evaluation methods can be added depending on people and places. Online evaluation capabilities may be available elsewhere within an institution.

Whatever the evaluation process is there are some problems associated with it. Common problems might come or appear as we use different sources of information. It is obvious that there is no one and only source which is best and universal. Maybe a second serious problem is the low percentage of returned questionnaires (if the evaluation is not mandatory). Sometimes students might be not serious or less responsible when they take part or when they get involve in the evaluation process.

Several factors could improve the situation. First of all students' feeling of usefulness and the benefits of the outcomes of the evaluation process need to be stressed. It is good practice to involve students in each stage of proceeding/treating the evaluation results. Give information about the conclusions and taking appropriate action is extremely important and easy to do at the same time. Another aspect which could be raised is whether the questionnaires are anonymous or not. All indeed are except for The Netherlands where they are semi-anonymous – a teacher doesn't know the name of the student but can answer the comments by sending a message to this particular student.

By gathering evaluation information one can make a judgment of his/her performance, decide what to do and how to do it successfully. However the practice in both Ireland and Poland is that the evaluation can be achieved or obtained by various and different ways. For examples either from students' feedback or comments on the particular course or modules or from externals professionals who might get involve in that program or activity. Sometimes also a direct evaluation assessment can be obtained by colleagues who might give comments or feed back based on their experiences. All these together will give more ideas for the instructors and their success or achievements.

Group Work

Leader:
Bill Byers, University of Ulster, United Kingdom

Reporters:
Martin Zmrzly, Brno University of Technology, Czech Republic
Falko Drijfhout, Keele University, United Kingdom

The session on group work was held on the day before the last day of the summer school and was led by Bill Byers.

Although the session was all about group work, topics such as Problem Based Learning (PBL) and Context Based Learning wasn't discussed, as these were discussed in a separate session. Tutorials were quite common in the United Kingdom, but due to time constraints and less money to spend, it wasn't used that much any more. Yet, one of the great benefits to work in groups is that it can help students in their independent learning curve.

After Bill briefly summarised the theory behind teaching, he focused on what the advantages of group work are. We were asked to discuss what **we** think the advantages are to work in groups. Each of the groups had to come up with a list of advantages. After a lively discussion (not only in our group) we came up with a list of several advantages. Some of these are:

- Students exchange experience.
- Students learn communication skills and how to work in a team.
- It can increase student motivation.
- It is possible to gather more information.
- As students use a similar language, they could easier explain to others.

Yet as in all things, there are always some disadvantages as well, and so we were asked if we could come up with some disadvantages. During our discussion it was clear that although there are several disadvantages, it certainly doesn't outweigh the advantages. In a plenary discussion all the disadvantages were summarised. These are what we come up with:

- Leadership problems can lead to friction within a group.
- Passive individuals.
- Use of wrong terminology.
- Group work does not promote independent learning.
- Can lead to misconceptions.
- How can individual assessment be carried out?

After summarising the disadvantages the discussion moved on to an important aspect of group work. Group work is there to *promote learning*! We mustn't concentrate in group work on ***how to work as a team***, but on *how to enhance student learning*. Teamwork is only a secondary aspect of group work.

Working in groups can be very successful if the following factors are taken into account:

- Be careful in deciding on the size of the group.
- Makes sure there are clear goals for each group,

One additional factor was discussed in more detail. How do we select our groups? Do we force the students in a group or do we let them make their own choice. The advantages and disadvantages of each of these methods were discussed but there seem to be no fixed answer. More important is to focus on the goal(s) of the group work and use this to decide how the groups should be formed.

Group work in the United Kingdom

In recent years the focus has been very much on using group work as a method of

teaching to promote learning in the United Kingdom. More and more the tendency is to move away from just giving lectures, but to involve students more. Not only to lighten the load for lecturers, but to enhance the learning of students.

In our University group work is frequently used. We use it for two different types of learning. The first is that for some of our laboratory practicals we let students work in groups of 2 or more (max of 4) during these lab classes. They still have labs in which they work independently, but they work frequently in groups. Although one important reason for this is that in this manner we don't have to have so many analytical instruments, this is purely a practical reason. More important is that in real life they have to work together with other people; especially for our students on the Forensic Science course. They have to work within a team and should be able to communicate their results to other people in the team. The team as a whole should then prepare their data so it can be given e.g. as court evidence. In this whole process communication skills are quite important. The second type of group work involves students working in smaller groups on problems during problem classes. The forming of these groups are random and students form their own groups. We use this type of group work so that students can learn from each other. It also helps students to come up with their own solutions through sharing their knowledge. On their own they struggle to get to the answer, but if they work in a group they perform better.

Group work in Czech Republic

Peer-group work is not a widespread way of teaching at chemical departments of our universities. In the theoretical area, there is not time enough to let students work out the seminar projects.

However, in specialized courses (in fourth and fifth year), mainly in laboratory practise, we usually make the students form groups of 2-3 to work together throughout the year.

We can afford to design the laboratory projects to be more complicated, since the students are ready to decide who can work on which part most effectively. Their work is nearly always successful. Moreover, in the end of the course, we let the student cooperate with other groups, preparing a final super-project, concluding all the years' work.

The peer group work of these skilled students is really effective. On the other hand, there is of course a strong disadvantage in assessment. Students are usually assessed based on their lab-reports. Students usually divide the schedule of the course among them – e.g. Mark will write the report of exercise 1, 3 and 5, Tom will write the rest. We can be almost sure, that a week after the end of semester Tom will remember completely nothing about exercises 1, 3 or 5.

These problems, however, do not outweigh the advantages of peer group work at all. Concluding, this way of teaching is not wide-spread in higher chemical education in the Czech Republic; it is however going to increase after solving some problematic details.

Disability Issues

Leader:
Iwona Maciejowska, Jagiellonian University, Krakow, Poland

Reporters:
Petr Dzik, Brno University of Technology, Czech Republic
Carlos Alonso Moreno, Universidad Rey Juan Carlos, Móstoles, Spain

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Introduction

There is a large and growing number of persons with disabilities in the world today. In most countries, at least one person out of 10 is disabled by physical, mental or sensory impairment, and at least 25 per cent of any population is adversely affected by the presence of disability.

The causes of impairments vary throughout the world, as do the prevalence and consequences of disability. These variations are the result of different socio-economic circumstances and of the different provisions that each society makes for the well-being of its members.
About 15 per cent of worldwide students in universities have some kind of disabilities. This percentage does not reflect the reality in all the countries. The facilities in the universities of determinant countries are not ideal to carry out a career. It is not only an infrastructure problem; a wide amount of teachers are not interested or motivated to learn properly how to teach people with disabilities.

Most Common Disabilities

It can be established that the most common disabilities are as follows:

- *SpLD (Specific Learning Difficulties):* People with SpLD have a language disorder that affects both semantic processing and the pragmatics of language use. It is difficult to make an individual diagnosis because the symptoms vary immensely.
- *ADHD (Attention Deficit Hyperactivity Disorder):* It is one of the most common mental disorders. The principal characteristics of ADHD are inattention**,** hyperactivity**,** and impulsivity.
- *ADD (Attention Deficit Disorder):* It is generally considered to be a developmental disorder. The disorder is characterized by a persistent pattern of inattention and/or hyperactivity, as well as forgetfulness, poor impulse control or impulsivity, and distractibility.
- *ASD (Autistic Spectrum Disorder):* People with ASD are afraid of everything. They have a really good memory and very important calculation skills. However, they have problems understanding social rules and gesticulate.
- *Asperger´s syndrome:* It is a condition on the autistic spectrum. It manifests in various ways and can have both positive and negative effects. It is typically characterized by issues with social and communication skills.
- *Dyslexia:* It is a learning disability characterized by problems in reading, spelling, writing, speaking, or listening. Many people with the condition are gifted and very productive; dyslexia is not at all linked to low intelligence. Often, a person with dyslexia has a problem translating language into thought (such as in listening or reading), or

translating thought into language (such as in writing or speaking).
- *Visual Impairments*
- *Hearing impairments*
- *Mental health difficulties*
- *Manual Dexterity difficulties*
- *Mobility problems*

Some Practical Tips to Deal with People Having Disabilities

General practical Tips

- Identify student needs.
- Employ extra time and extra attention to work with them.
- Know what to do in an emergency.

Visual Impairments

- Visually accessible presentation.
- Talk about pictures.
- Use of lecture notes.
- Large size labels.
- Front seats.
- Use of recording machines.

Dyslexia

- Ask them to read loudly.
- Oral examinations.
- Use of capital letters.

Autistic/Asberger's

- Do not be angry, do not lose patience.
- Allow breaks, do not make jokes.
- Minimise distractions.
- Give frequent reminders.
- Ensure student attention.
- Use positive communication.

Situation in Spain

23% of the Spanish population has a kind of disability, but fewer than 1% studies at university. All of them have the same rights as other Spanish people, but serious problems regarding infrastructure facilities in the universities limit the chance to develop a career in Spain. Furthermore, Spanish teachers are not capable of dealing with people with impairments. Not enough training is provided by the Spanish government in order to improve their teaching skills and amply their knowledge in this matter.

Situation in Czech Republic

In order to describe the current situation of higher education of people with disabilities in the Czech Republic, it is important to understand the historical background of this problem. While the situation of people with disabilities in the western European countries has gradually and continuously improved for a relatively long period of time, in theCzech Republic this has only been true for the past 18 years.

Before 1989, a strict communist regime ruled the country. Although serious political, economic and social problems were devastating the society, the political leaders were either not able or not willing to install any effective measures to solve them. Instead, citizens were brainwashed by aggressive propaganda telling stories of our successive approach towards communism.

In such political and social environment, people with disabilities were naturally seen as a problem, but very little was actually done to improve their social status. They were given quite generous pensions and in return were expected to live quietly on the edge of the society, possibly not spoiling the image of happy socialism. At those times, almost no public building was wheelchair accessible and children with disabilities were educated in special medical institutes, absolutely segregated from the "normal" population.

However, everything changed rapidly within a few years after the Velvet Revolution in fall 1989. Czech society gradually turned into a democratic citizen-based society and positive changes have been taking place in all aspects of life since then. A huge number of non-profit non-government organizations have started to fight for the full integration of people with disabilities into the society and for the respect of their human rights.

Their struggle of course included the education process of people with disabilities. Nowadays, we can witness a major shift towards the integration of pupils and students with disabilities into standard classes. School headmasters have very strong authority and can freely organize the curriculum and educational process of students with disabilities, so that as many as possible of these students can attend their local ordinary school.

However, the situation is still far from being perfect at the university level. While there are basically no obstacles for entering faculties of law, economics, philosophy etc., it is still very difficult for a person with a disability to enter a faculty of medicine or chemistry. In order to enter a faculty of chemistry in Czech Republic, students have to submit a statement signed by their doctor that they are mentally and physically fit to study chemistry. The list of health disorders preventing them from studying chemistry is given in a government act.

While there are very good reasons for this legal regulation, namely safety at practical laboratory work, it can certainly be considered as a sort of discrimination. However, there are fields of chemistry where there is no laboratory work at all. Theoretical or computational chemists rarely enter laboratories, do they?

Conclusion

As far as the our countries are concerned, it seems that the universities, and especially faculties teaching natural sciences including laboratory work, are slightly behind in the general trend of the whole society towards the integration of people with disabilities. We believe we can develop new study programs focused on theoretical aspects of some natural sciences so that even students with certain disabilities can experience the benefits of higher education.

Portfolios

Leader:
Jos Koeckhoven, Utrecht University, The Netherlands

Reporters:
Dariusz Matoga, Jagiellonian University, Krakow, Poland
Catherine Duckett, Keele University, United Kingdom

The last but one session on Saturday was led by Jos Koeckhoven who discussed portfolios and their meaning for teachers in higher education. He began with an introduction explaining the French origin of the word and its common use in casual language. Items that could be part of a portfolio were given. The main components were: self-evaluation, curriculum vitae and course descriptions. An example of the self-evaluation part was presented including:

- scientific capabilities (teachers' education and teaching roles including planning and developing the teaching, difficulties encountered, changes introduced).
- personal teaching philosophy (own statements and thoughts).
- didactic capabilities (various experiences in education; detailed list of current teaching including schedules, timetables, students).
- development of education and organisational capabilities (design and coordination of courses).
- linking research and education (both aspects reinforce each other and the research elements in the early stages of career are very important).
- personal challenges (educational visions and innovations for the future).

The portfolio may be put together over the first two years of teaching, and it is recommended that new lecturers consider investing some time in this, regardless of whether an institution has such a requirement. The portfolio can illustrate how you have developed as a professional teacher, and in particular how you have reflected on, experimented and developed your teaching over such a time.

A brief history on the educational situation at Utrecht University in the Netherlands was presented. Before 1995 the quality of teaching was not guaranteed by any form of certification and the energy devoted to teaching did not influence the status and careers of faculty members. In 1995 Utrecht University started to improve the status and appreciation of the teaching role and the quality of teaching. It resulted in the introduction of training programs for teachers leading to official qualifications called Basic Teacher in Higher Education (THE since 1997) and Senior Teacher in Higher Education (since 2001). The THE degree in teaching has been similar to the PhD degree in research and the portfolio has been essential in assessing this qualification. Such an assessment of the THE candidate should focus on:

- capabilities regarding contents (the teacher possesses a wide and profound knowledge of the discipline concerned and is aware of the place of his/her own teaching in the faculty curriculum).
- didactic capabilities (the teacher is able to design teaching programs; to perform various teaching activities both for groups of students and individuals; to examine students; to evaluate his/her own teaching).
- organising capabilities (the teacher is able to cooperate with colleagues and to give guidance to PhD students participating in teaching tasks).
- general capabilities (the teacher behaves in a committed, communicative, social and skillful way, dealing with students and colleagues and is able to further develop and reflect on his/her own teaching).

Since the very first staff portfolios at Utrecht University differed greatly in structure and content and often lacked essential items, systematic assessment procedures defining faculty criteria and an assessment matrix were introduced. The best assessed portfolios were those containing analysis of strong and weak sides of aspects in teaching qualities, named in the assessment matrix. In conclusion, the core of the portfolio should be the candidate's own commentary, and the portfolio should contain strong and weak points analysis and be evidenced with documents. The final recommendation was that feedback is essential to stimulate a systematic reflection on teaching and subsequent improving it.

Group discussions showed that in some countries (the Netherlands, UK, Ireland, Fnnland) teacher qualifications, and hence the requirement to complete a portfolio, already exist for new lecturers, and increasingly are becoming compulsory. In other countries such as France, Poland, Spain, Austria, Czech Republic, Bulgariaand Lithuania , the portfolio system has not yet been introduced. The participants from the countries not having portfolios asked Jos and other participants about the THE degree: When do teachers obtain it? What body awards it? How much time in average does it take to prepare a teaching portfolio? What experience have you had putting a portfolio together?

Jos ended the session with a group discussion, asking participants to reflect on their own teaching on the basis of bad and good experience. There were four categories to be reflected on, the same as those which are assessed in portfolios at Utrecht University. Discussions were also held over what 'reflection' is, what it can be, how you can do it – for example writing a regular teaching diary on your experiences, reflections and incidents. It was noted that the majority of the delegates reflected in some way during or immediately after a teaching session, or at the point of self-evaluation, but very few wrote these reflections down, or reflected regularly.

This session - which ended with individual reflections - was a good starting point for those who do not yet have their own portfolios to think realistically about preparing them.

Supervision

Leaders:
Bill Byers, University of Ulster, United Kingdom
Iwona Maciejowska, Jagiellonian University, Krakow, Poland

Reporters:
Tell Tuttle, University of Strathclyde, United Kingdom
Mariusz Barczak, Maria Curie-Sklodowska University, Lublin, Poland

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The primary focus of the supervision session at the summer school was to provide the participants with an overview of the supervising process and how it relates to their general teaching activities. In addition, the session aimed at identifying and developing the skills connected with supervising different learning activities. During the lecture different aspects of supervision were briefly discussed. To understand what the role of the supervision is in the educational process it is very helpful to answer several question. Three of them were posted by Dr Byers.

What do we mean by supervision?

The answers from the audience groups were quite similar and several interpretations of the term supervision appeared. Typically supervision was understood as an activity carried out to oversee the productivity and progress of learning of students. Supervision is a management activity and teachers have a management role in the organization of the process of learning. Sometimes the terms "leadership" and "supervision" are interchanged because both activities are closely related. Supervision requires leadership; however leadership does not necessarily have to involve supervision. Supervision involves the collection and analysis of information about students learning process based on established and understood criteria. As such, constructive criticism is an important role of the supervision process as it makes the students aware of inadequacy of progress or of standards of work below that are expected. These different aspects of supervision were summarized in Dr. Byers' definition of supervision as "the level of constraint that the person in charge has to apply to achieve a certain outcome."

Why supervision is necessary?

According to summer school participants there are several reasons which make the supervision process necessary during the educational process. Among them the following aspects appeared:

- To enhance successful and dynamic learning.
- To ensure that the goals of education are being achieved in an efficient, effective, and systematic way.
- To improve the quality of instruction through acknowledgement of successful teaching practices, as well as encouragement and assistance during learning.
- To improve teachers' professional growth and positive contribution to student development.
- To address and control the official requirements, for example safety regulations.
- To introduce the idea of working for a boss.
- To provide group structure and avoid anarchy.

How the situation differs between school and university?

General answers of the delegates to this question were similar. It was noticed that there are some important difference between supervision in the schools and university. First the most obvious thing is that during the school learning process a supervised person has less personal responsibility, as the parents are still involved in the educational process. In contrast to school, the university students have full responsibility for the learning process and supervision should be a process

involving only a student and teacher relationship. This also means that supervisors should be accessible to students as appropriate at other times than formal meetings. Supervising in school requires more ordering and strict treatment of each student while at the university supervising is generally connected with advising and suggesting some solutions and improvements rather than strict governing. In university the importance of supervising is placed on the development of independence of the supervised person. However in both cases it should be a critical process.

Supervision styles

The component of the session presented by Dr Maciejowska introduced different learning activities, which are (or should be) supervised during the educational process. Among them we can distinguish such learning activities as lectures, laboratories, tutorials, seminars, calculations/exercises, project works, bachelor, master and doctor theses, examinations, work placements (industrial, teaching), and field/industrial visits. Given the range of different situations where supervision is required it is clear that the type and extent of supervision must be flexible to adjust to the various contexts. In the table, the manner in which the primary aim, the safety considerations and contact between supervisor and student can vary between three different supervision scenarios is given.

The style of supervision can differ strongly as there are a lot of factors that can influence it. However, we consider the most important variables in any setting to be the lecturer, the student(s), and the situation. Thus, supervision is an ongoing process and demands from the supervisor a lot of flexibility and responsibility.

Differences between the UK, Poland, and other countries

Comparing the situation regarding the current level of university supervision in the United Kingdom and Poland we believe that the aims and methods of supervision are rather similar and that there is not a lot of differences in supervising/learning activities. However in the case of the UK the supervising capabilities of the teachers are subjected to systematic assessment. Whereas, in Poland there is not a regular way to assess the effectiveness and efficiency of teachers' supervision. A similar sentiment was echoed by delegates from other countries.

Conclusions

Finally, the session on supervision was rather thought-provoking. Although many of us have supervised students in various roles, we have often not considered a certain position as a supervisory one (e.g. lecturing a class is often not considered supervision due to the minimal personal contact involved). As such, the main take-home message from this session was to consider how supervision plays a part in our varied interactions with students and to modulate our interactions in response to these additional considerations.

Table. Role of Supervision in Different Learning Contexts

	Lectures	Laboratories	Masters Thesis
Aim	Construct the course content.	Teach skills and good laboratory practice.	Foster independent researcher skills.
Safety considerations	Minimal health and safety requirements.	Large degree of personal responsibility.	Increasing the student's role – lesser role for supervisor.
Contact	Minimal personal contact	Greater personal contact with the students	Most personal contact with the student.

Networking and Conclusions

Leader:
Paul Yates, Keele University, United Kingdom

Reporters:
Ellen L Heeley, The Open University, United Kingdom
Lukas Richtera, Brno University of Technology, Czech Republic

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The final session in the ECTN meeting (Networking and Conclusions) involved the participants reflecting as a whole group, on whether or not, the original expectations and aims of the summer school were achieved. In the first session of the school, the whole group were asked the question of 'what they hoped to gain from the summer school' during the networking, formal and discussion sessions in the week planned ahead. From this, five common areas where identified as:

1. To share experiences in teaching chemistry at a tertiary level.
2. To gain knowledge of non-traditional methods to enhance teaching and learning.
3. The development of different teaching styles to aid and improve efficiency.
4. Curriculum development. Create a positive atmosphere in the classroom.

It was hoped that a majority of these areas would be examined and developed in some of the formal sessions and that the participants would be able to share experiences from teaching in their home universities. It was also envisaged that in bringing together newly appointed chemistry lecturers from a varied mixture of different European universities, it would provide some understanding of the different approaches these universities have in teaching chemistry and the expectations made of the individual lecturer. However, it was not intended or expected that the school would identify any one superior way of teaching chemistry at a tertiary level, but rather to provide all participants with a greater appreciation of the differences throughout Europe.

By the end of the summer school most participants felt that their expectations had changed form the initial list and that the sessions had provided them with a greater breath of topics and insight, than that which was originally envisaged. One topic that was very well received was the introduction to pedagogy. This gave an introduction into the practice of teaching and the ways in which a student learns, which was a new insight for many of the participants on this subject area. However, it was noted that many of the participants would have found a glossary of terms that are commonly used in teaching and pedagogy very useful (to cover all sessions). A further session which proved popular to the participants, were the three sessions on 'presentation skills'. It was a consensus that these sessions were invaluable in allowing the groups of participants to analyse and discuss their own and other participants performances after a short presentation. These sessions not only allowed the participants to obtain advice about developing and enhancing their own presentation skills, but also explored some of the problems faced and how these were resolved, in teaching chemistry by the new lecturers in their respective institutions. However, one topic that was not discussed from the list above, was 'curriculum development'. All participants did comment on the fact that they would have found this a useful session and hope that it could be included in future summer schools if run.

Throughout the summer school it was apparent that there were large differences in the teaching procedures and support for new lecturers in chemistry across Eastern and Western European universities, represented at the School. For example, one session examined the level and provision of training a new lecturer received in their respective institutions, another session discussed the development of e-learning in the subject (being specific to the actual course and university). It was seen that the 'specific' training for new lecturers did tend to vary

greatly across the European countries represented at the school. This was seen in the form of specific courses provided and the award of a qualification in teaching at tertiary level in the UK for example, compared with a more relaxed informal mentoring system across other European universities. Interestingly, the use of e-learning in universities was being developed equally across Europe, with many lecturers taking the initiative in wanting to/or currently developing e-learning components for their courses. The invaluable and diverse information that can be communicated about any aspect of teaching chemistry in European universities, was seen to be a major benefit of presenting such a summer school as the ECTN and hence the networking opportunities that the school developed and encouraged with its participants.

Overall it was agreed by all participants, that the summer school allowed a great deal of networking to be done and a range of experiences to be shared and interesting aspects of teaching chemistry to be explored. This was an invaluable aspect of the School over the week but, in the last session it was important to address the question of what further benefits would be achieved if there were some provision in the whole group remaining in contact with each other by some agreed means.

It was decided that the benefits of such a group staying in contact with each other would be positive step but, it was felt that this had to be through the choice of the individual. The group including the presenters, decided that it would be beneficial for the discussions to be continued via the email group system that had already been set up and used for introductions and exchange of information before the summer school started. The advantages of using a group email site is that all participants could be involved with discussions and the sharing of information at any level that they choose, but that the site would always be active for any contributions in the future. Other areas of communication and collaborations that could be formed by individual members of the group were seen in the variety of ways, for example those with common research interests. Thus, the summer school was successful in introducing people and facilitating discussions and collaborations not only in the methods of teaching chemistry at a tertiary level but, also with scientific research areas in chemistry.

Some of the participants felt that it would be useful on an individual basis, to become a committee member of the ECTN and thus, have the opportunity to attend and participate in annual and local meetings. This would be an opportunity to report on the usefulness of the summer school and developments since, as well as promoting its continuation in the future. It was unanimous that all participants felt and expressed such, that the ECTN Summer School for Newly Appointed Lecturers in Chemistry should continue in the future (funding permitting) and that it was certainly beneficial to all the participants at this year's school and those who may have the opportunity to attend one of these summer schools in the future.

Since the summer school ended there has been a great deal of continued activity and communication by the group on the designated email site. All presenters have provided a bank of files and CD material which were freely available for all participants to download, these files include specific presentations that were made and further information of useful materials and websites that can be accessed if required. This has been well received by the participants and has enabled them to delve into the wide range of teaching materials that are freely available which they may not have been aware of previously. Participants have also continued to use the group site to communicate both on a sociable and academic level. Also, suggestions have been made at some universities post summer school, that there are possible opportunities to organise workshops/conferences on teaching chemistry in that particular country or region. This would be of benefit to share experiences and unify the teaching of chemistry at a tertiary level in that country. Certainly in the UK, there are already regular conferences organised to bring together chemistry lecturers at any stage of their teaching careers.

Finally, the suggestions made during the summer school and the continued activity in keeping the email site and general contact still active within the present timescale, clearly

highlights the interest and commitment that the participants and presenters have made beyond the week spent in Malta. It also highlights the enthusiasm of participants to take away and share their experiences and knowledge with other members of staff at their respective institutions and hopefully relay this in the teaching of chemistry in the future.