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## 1. The sweet smell of Aromatic Substitution

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**Course : 2<sup>nd</sup> year Chemistry  
Software : TLTP Chemistry Courseware Consortium (C<sup>3</sup>)**

**This case study describes how one department made its initial venture into the use of learning technology. Key points leading to its success were:**

- **Planning was spread over several months.**
- **The software selected was challenging and directly relevant to other course materials.**
- **Student reactions were very positive.**
- **Network problems did not lead to insurmountable difficulties.**

### **Aims and Objectives**

Glasgow Caledonian University supports an internal programme of developments in teaching and learning, to which all staff or departments may apply for funding. Innovation in teaching is, therefore, positively encouraged within the institution. The university also has a record of excellence in the creation of software to enhance teaching. In common with other departments, Physical Sciences are constantly monitoring good practice in teaching and learning, and seeking innovative ways to improve the learning opportunities offered to students.

It was in this climate that the department decided to investigate the opportunity for using computer based materials within some chemistry courses. Conscious that much has been invested nationally in the development of resources to support teaching and learning, the original hope from the two members of staff running this project was to develop a resource centre containing a wide range of materials that students could use on an open access

basis. LTDI were contacted for advice and guidance in establishing these resources.

Initially a few meetings were held where LTDI and departmental staff discussed the variety of courses being delivered, and those specific areas where students were identified as having greatest difficulty. Technology was perceived as being one possible tool to enhance the students' understanding of chemistry. It became clear that more benefit might be expected from integrating technology more closely with other resources and delivery methods, rather than providing courseware as a supplementary tool which might then be regarded by students as rather detached from the core of any one course. There are a number of possible difficulties associated with an open access resource centre, most of which revolve round student motivation, and a perception that such materials do not play an important part in the course, and consequently do not merit much time or concentration from the individual student. Until students are familiar with the role of computer based learning materials their use is often more successful if they are firmly embedded within the main delivery strategy of the course.

The plan to develop a resource centre as a first step towards using technology evolved, therefore, into a plan to integrate computer based materials with one aspect of one course. It was decided that one of those areas earlier identified as being more challenging for the students should become the focus for this integration, hence the next stage was to search for software which might be suitable.

### **Overview of the Project**

Over about six months, through contacts with the CTI centre for Chemistry and LTDI, a number of packages were identified as potentially of interest. Actually obtaining materials for evaluation purposes was not always straightforward, particularly in terms of pressure on staff time, and difficulties in installing materials. In some cases printed publicity was all that was available upon which to base a judgement. One package (Aromatic Substitution, from the TLTP Chemistry Courseware Consortium, C<sup>3</sup>) was identified as

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closely matching the content of part of the second year CITI (chemistry, information technology and instrumentation) course.

Staff were confident that the students had good levels of competence in general computer use, and given the institutional record in the development of courseware, it was expected that some students would have had prior experience of using computer based learning materials. One large computer lab was booked for the appropriate session, and arrangements were made for the software to be loaded onto the machines.

The computer based session was planned to replace a standard tutorial, and was supported in this case by two institutional staff, with backup support available from a technician. The Aromatic Substitution package is an MS Windows™ tutorial package, divided into three units, with questions and activities throughout. All the material in the first unit had already been delivered to students through a series of lectures, and developed in tutorials, but was also felt to be of critical importance to the students' overall success in the course.

With the support of LTDI, the institutional staff worked in detail through the package, identifying a number of stages where some guidance might be needed, particularly where differences in notation occurred. It was felt that there was no need to set the students tasks other than those already contained within the package, and that the content matched the lecture course so closely that students would not have any difficulty in identifying the important nature of the material. A sheet of information was prepared to indicate which units (one and part of three, but none of two) should be attempted, and to explain some of the notational differences. The students were not told in advance that this tutorial was to be held in the computer lab.

It was decided to evaluate the implementation by observation and through a questionnaire. A brief questionnaire was drawn up, to be completed in stages through the tutorial. It requested responses about how the students felt about computers generally, and then sought information about the package in question.

Up to this point things had gone smoothly, if perhaps a little slowly. On the morning of the tutorial, the network was down and one of the members of staff was needed to cover for a

colleague who was ill. Students were given some reading materials and asked to return in one hour, in the hope that the network would then be restored. In an hour, about six machines were working, with some of the others slowly being reset. It was decided to proceed, and to ask the students to try out Aromatic Substitution. The difficulty with the network did however mean that not all students could start the exercise together, and that they were being asked to work in groups of four, rather than in pairs, and were rather squashed in that half of the lab which was up and running. This staggered start, together with the reduced time now available, meant that not as long was spent highlighting the few possible problems with the package as had originally been planned. Perhaps this was not a recipe for a great learning environment, however....

### **Evaluation**

It was evident almost immediately that all the students were involved and interested. There was an excellent atmosphere with the students keen to work through the package. The use of questions throughout the package promoted a great deal of student interest, and soon all groups were deep in discussions, with students pointing to the screen to explain to a peer why a particular substitution occurred, and with others jotting down notes or diagrams to supplement their lecture notes. No student had navigation problems within the package, although it was noticeably slower in operation than when it had been tested by the staff. On the whole students ignored the prepared information sheets and attempted to work through the whole package, including those topics in unit two not included in their syllabus. The teaching staff were able to circulate amongst the students, posing or answering questions to reinforce the learning that was taking place.

The evaluation forms were very positive: students found the package easy to use and enjoyable; it helped them to understand the subject and made it more interesting; they felt that it fitted in well with the rest of the course, and the content was challenging, all despite the lack of time and the cramped conditions. Initially the students were overwhelmingly confident or reasonably confident using computers, and MS Windows™ in particular, although about a third would not use computers unless they were forced to. Twenty-three out of twenty-five students responding

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indicated that they would like more computer based learning materials to be used in their course. The comments made by students indicated that they had been thinking :

- “Challenging, but good revision”
- “Good revision questions, and if it (the student’s response) was wrong it (the package) explained how in the chapter”
- “The package was easy to understand”
- “Good questions, taxing to the brain”.

### **Conclusions**

This was the first time these lecturers had used computer based materials with students. Despite the network problems it was a hugely positive experience, largely because time and trouble had been taken to identify a package that was appropriate for the rest of the course. Because the materials matched the course

content so closely little was required in the way of tailoring or preparation of supplementary materials.

Staff felt that students were more actively involved in learning than in some more traditional situations, encouraging a deeper level of understanding. The computer based materials were being used to supplement other teaching techniques, creating a richer overall learning environment. The design of the package, with frequent and challenging questions, also promoted a good atmosphere within which learning could take place, and was crucial to the success of this implementation.

With the experience gained the staff now plan to introduce another computer based session into another course. Thence the intention is to build up, one at a time, a bank of resources that the students will be introduced to within contact hours, but which can also be accessed for self study or revision purposes.