The Impact of TLTP on Undergraduate Chemistry Teaching

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Introduction

This paper gives an overview of the developments that have taken place in TLTP projects related to chemistry. Particular emphasis is placed on the Chemistry Courseware Consortium, which has developed CAL modules for use in first year undergraduate chemistry courses. The design philosophy, evaluation, and examples of how the material has been used in a number of institutions are briefly discussed. The paper concludes with a summary of the current and predicted future impact of TLTP on chemistry teaching.

The Teaching and Learning Technology Programme (TLTP) was funded by the Higher Education Funding Bodies of the United Kingdom from August 1992. The funding came in two phases, and a total of seventy six projects were supported. Approximately one quarter of these projects were designed to facilitate institutional change, primarily through staff development. The remaining projects were involved in software development using consortia of academic staff.

A total of three TLTP projects in chemistry were funded during the two phases[1,2]. The 'Chemistry Courseware Project' (which is better known as the Chemistry Video Consortium or CVC) involved a consortium of thirteen principal sites (led by the University of Southampton), and proposed to produce new material for teaching chemistry, concentrating on the application of video disk technology to laboratories, lectures and self-paced learning[3]. The use of video in chemistry has a number of advantages unique to the discipline. Due to the Control of Substances Hazardous to Health (COSHH) regulations, a series of experiments are no longer permitted in undergraduate laboratories. These experiments are often beneficial to the learning process of the student, and video permits the student to see the experiment without risk of danger. Another distinct advantage of video is that self-paced instruction in laboratories and learning resource centres gives students the opportunity to familiarise themselves with experiments prior to laboratory classes, saving time, materials and personnel. To date, nineteen video disks have been produced, and are being distributed world wide by Films for the Humanities and Sciences[4].

The second project was entitled 'Computer Simulations for Teaching Practical Design and Data Handling', and was a consortium headed by the University of York. The aims of this project are fairly self-explanatory from its title, and to date, eleven packages are at various stages of development.

The final project was entitled 'The Development of Courseware for Chemistry Teaching', which has become known as the Chemistry Courseware Consortium (or C^3 or C-CUBED for short). The rest of this paper will concentrate on the work undertaken by this group.

Chemistry Courseware Consortium

Overview

Prior to TLTP, a number of CTI Centres diagnosed that a lack of good courseware was a major stumbling block in the uptake of CAL[5]. High quality courseware for chemistry was virtually non-existent[6], mainly due to poor machine performance and the absence of graphic visualisation in the early generations of PCs. Thus, the formation and funding of the Chemistry Courseware Consortium was fortuitous as it coincided with the rapid improvement in PC hardware, and its deliverables would meet the demand from the chemistry community for acceptable CAL materials.

The project (led by the CTI Centre for Chemistry at the University of Liverpool) decided to address four key areas of chemistry (basic chemistry, theoretical methods, spectroscopy and shapes of molecules), developing the subjects as a series of resource modules (otherwise known as 'resourceware'), with the first such module in each area being targeted at approximately A-level standard. Research by the CTI Centre showed that the PC was the dominant platform used for teaching in chemistry (approximately 59% of installed base)[7], and hence the courseware was developed for use under Microsoft Windows. Each module was designed to adhere to the Windows interface standards[8], which meant that students who had used Windows before should be able to understand the interface quickly, and those who had not should be able to use other Windows programs as a result of using the courseware. The modules were designed to teach and not to test, and due to the nature of the subject, priority was given to the extensive use of visual material (keeping text to a minimum). As well as CAL modules, the consortium also produced several educational animations which may be used in lectures or tutorials.

Deliverables

The consortium has released eighteen CAL packages (all of which consist of a number of separate modules) and four generic teaching tools (which may also be used as stand-alone products). Modules have been delivered to over one hundred institutions (including some schools and further education colleges), and to a range of departments. In total, more than seven hundred modules have been delivered in the UK. After an initial large scale student evaluation of the pilot module (Elementary Radioactivity)[9], each package has undergone extensive peer review, and a number of the final products have been independently evaluated[10,11,12,13,14,15]. A study of the usability of one of the products has shown the courseware to be of commercial standard[16].

Discussion

As a result of the TLTP projects, a large body of educational technology resources has been created. This has begun to fulfil the need for this kind of material which was identified earlier[6]. However, if all the time and money invested in development is to have an impact on the teaching of chemistry, the material must be used as part of chemistry degree courses, and must significantly change the way chemistry is taught. Two examples show how this has begun to take place.

The University of Liverpool chemistry department adopted the use of a number of the basic mathematical modules (from the theoretical methods courseware) as part of its first year course

in the 1994/95 academic session. These were timetabled as a replacement for some tutorials. Student surveys showed that the software significantly helped the students in basic mathematical skills and in feeling more comfortable with using computers[17]. Secondly, at the University of North London, consortium software has been used in a number of courses in conjunction with CAL tutorials produced by the department's own staff[18]. An institution specific front-end to the courseware was developed using Authorware, and this is a good example for how the consortium software has been used as a resource alongside existing CAL materials and teaching methods.

A survey of all institutions using the courseware showed that of those who responded, over 80% of departments had placed the courseware on networks for student use outside timetabled hours, but were planning on incorporating one or more of the modules into the curriculum for the next academic session[17,19]. A large number of departments had also used the generic teaching tools as part of their course (particularly in laboratory exercises), and from the responses received, just under one thousand students had experience in using two such tools (the periodic table database and the data analysis module)[17]. These figures are now likely to be much higher, due to the low numbers of returns to the questionnaire (approximately 25% of the those approached), and a large increase in module distribution since the survey.

Conclusion

The TLTP products designed for use in chemistry higher education are just beginning to have an impact on the way chemistry is taught in the UK. However, as the availability of such material increases, the early signs are that the use of TLTP products will increase dramatically, and have a significant impact on teaching. Therefore, it would seem appropriate to suggest that to date, much has been achieved in terms of development of material, but it will be the implementation and use of such materials that will determine the extent to which TLTP has been a success for chemistry teachers.

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