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Physical Sciences

LTSN Physical Sciences News

...supporting learning and teaching in chemistry, physics and astronomy

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Special points of interest:

- Enabling accessibility in the curriculum
- Using C&IT in teaching
- What's new at the Centre
- More development projects are due to start in October

In this issue:

A bumper newsletter issue!

We decided that the original format of our newsletter was too restrictive so we have substantially increased the number of pages to 8 or even 12 pages (as in this issue). The newsletter will now be issued twice yearly, in Autumn and in Spring.

The focus of this newsletter is accessibility in the curriculum and we have two articles dealing with this aspect. To put the theme into context, below is a quick guide to the law and codes of practice involved...

The **Disability Discrimination Act 1995** outlawed discrimination against disabled people in employment, the provision of goods and services and the selling/letting of property. Education was exempted but provision of other services by educational institutions was not.

The **Human Rights Act 1998** brings into UK law certain provisions of the European Convention on Human rights. This came fully into force in the UK in October 2000 and ensures the 'right to education' and a 'prohibition of discrimination' in the enjoyment of convention rights. Implications with respect to higher education are not clear.

The **Special Educational Needs and Disability Act 2001** became law on 11th May 2001. The Act legislates for the prevention of discrimination against disabled staff and students in the provision of education, training and other related services. From September 2002 the new legislation is effective although there is an additional year (until September 2003) to allow the incorporation of reasonable adjustments (eg induction loops) and a further two years (until September 2005) for physical adjustments to be made (eg access to buildings). At present, Northern Ireland is excluded from this new legislation.

The **Code of Practice for the Assurance of Academic Quality and Standards in Higher Education: Students with disabilities** (published 1999) describes 24 precepts or standards that institutions are expected to meet. These cover all aspects of an institution's relationship with students, including teaching and learning. Institutions are expected to treat disabled students as an integral part of the academic community. QAA auditors will use the Code as a benchmark during assessments.

The Centre has created a *teaching and learning* toolkit on this subject. This document is intended to help teachers understand the issues relating to accessibility and provision of the curriculum in the physical sciences. It brings together relevant reports and information about useful resources with hyperlinks to allow further investigation or downloading of materials. You can find the link to the toolkit on the home page of our web site.

The remaining article featured in this newsletter is a final report by the ASTER project. This project researched the impact of C&IT on small-group teaching in UK higher education and produced a number of case studies in the physical sciences area. ■

Integrating accessibility into teaching

Article by **Simon Ball**, a Projects Officer for TechDis, The Network Centre, Innovation Close, York Science Park, York, YO10 5ZF.
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After completing a PhD in Ecology at Lancaster University in 1998 followed by a period working in industry, Simon joined the TechDis team in 2001. Although the JISC TechDis team's remit covers all issues in further and higher education related to technology and disabilities, Simon's particular fields of interest at present include European directives and legislation, Design-for-All, and E-Learning issues including Accessibility of Computer-Based Assessment.

From September 2002 all higher education institutions are obliged under the Disability Discrimination Act (DDA) 1995 (1) and the Special Educational Needs and Disability Act (SENDA) 2001 (2) to ensure accessibility for all at every level of consideration, from course content to the provision of leisure services. After months of anticipation and preparation the legislation will soon be put to the test. Most academics will be aware that they have to do something to make their materials accessible for disabled students, but some are as yet not entirely sure what they can do, or what they have time to do. This is particularly true in subjects such as those within the Physical Science disciplines, where practical classes are a vital component of the learning experience, and one of the trickier aspects of teaching to address. Hopefully this short piece will assist those of you who are trying to integrate accessibility into your teaching and maybe provide a resource for those last few who are still unwilling but who may end up being forced by law to act. I apologise if my previous sentence is patronising, but SENDA is now upon us, and I am sure that those who do not meet it head-on will experience serious problems at some point in the future.

In the following paragraphs I have tried to highlight some of the issues that might just arise within the teaching of Physical Sciences. I confess my academic credentials in the area are limited, but as an environmental scientist I do have experience of a field that is not a million miles away in terms of teaching situations. Some will be basic and obvious, others much more tricky to implement, but please do have a look through and think about how you could apply them to your own situation.

The Teaching Environment (Lectures, Tutorials, Seminars etc)

- Face the class at all times when speaking (to enable lip-reading). Stop speaking when turning away (and don't continually pace up and down), and always repeat questions asked from the audience so lip-readers can follow.
- Fully describe diagrams and pictures (for those who cannot see effectively).
- Where possible offer handouts and especially reading lists in advance of lectures (to enable those who need to obtain specific formats to do so, and to give students background knowledge so that they can follow the lecture, for example someone who lip-reads cannot simultaneously make notes).
- Wear a microphone if in a large lecture theatre or if someone requires use of the induction loop.
- Keep the amount of information on each slide and overhead to a minimum (ten slides with 15 words each vs. two slides with 75 words each).
- Use a sans serif font (Arial, Verdana, Tahoma) on all typed materials including slides and overheads.
- Be aware of colour blindness and poor contrast (you cannot see yellow on an overhead at the back of a large lecture room).
- Do not single out audience members for interaction unless they volunteer. This could be detrimental to students with some mental health difficulties.
- Encourage guest speakers to observe the above rules.
- If you have time, team up with a few colleagues and present a two-minute lecture to each other, to obtain feedback on your teaching style. Better still, get a student to video one of your lectures and watch it on playback ("Do I really wave my hands about that much?", "I could do with using a pointer for those overheads", "That explanation was about as clear as mud" etc)

Laboratory Practicals

- Ensure emergency procedures are known by every student, in particular relating to evacuation of wheelchair users, alerting of deaf students to alarms, or operation of fire extinguishers or washing facilities. Introduce blind students to the laboratory in advance of the practical, inform them where they may encounter dangerous machinery or hazardous chemicals. En-

Integrating accessibility into teaching

Ensure students know in advance what is to be expected of them and let them decide whether or not they can participate

sure safety procedures are followed to the letter, particularly with regard to clutter on the floor or desks which may cause problems for students with mobility or visual disabilities.

- Keep laboratory noise to a minimum, and provide typed instructions for students who may not be able to hear you or read from the board.
- If possible ensure the department possesses an adjustable-height workbench, rubber lap-mat and other equipment for wheelchair users to operate safely and successfully.
- It is vital to establish at the outset whether actually performing a task is necessary to achieve the intended outcomes, or is simply knowing how to do it (so you could instruct an assistant) sufficient.
- If understanding and knowledge can be acquired by observing or working with an assistant, many barriers to accessibility can be removed. However, do still ensure the student with visual or mobility difficulties knows exactly the processes going on, and if possible give them chance to instruct others to reinforce the understanding they might miss from not performing the practical task directly.
- If it is deemed an essential part of the module that all students perform a prescribed task(s) and that there is no suitable alternative that students with certain disabilities might perform then an equivalent alternative study path should be devised so as not to incorporate that task. The alternative study path should be offered to all students as a viable alternative to the original task.
- In case of challenges on the grounds of disability discrimination, in particular with relation to 'alternative' tasks or modules, you should ensure that the process of determining core objectives, and the setting of appropriate tasks and assessments to accomplish them, should be transparent and fully documented.

Field Trips (including specialist equipment experiences)

- Field trips and equipment experiences should be made as accessible as possible. For example if you take students on a guided tour of a power station, perhaps take an extra assistant to describe the visual input to a blind student. Find out if there is wheelchair access, or if certain parts of the tour are inaccessible see if there is an alternative experience offered for wheelchair users.
- If your planned trip or experience is not accessible, under the legislation you should consider alternative trips that may be accessible. This is not to say you should decrease the quality of the learning experience, but if there is a suitable location a few miles further away, then you will be expected to consider relocating the trip.
- Ensure students know in advance what is to be expected of them and let them decide whether or not they can participate. You may see no wheelchairs in your class, but do you know who has a problem with heights, going underground, spinning machinery or flashing lights? Hidden disabilities such as mental health issues may be widespread among students.
- Talk to the disabled student about what is involved in the trip and what requirements they have. It may transpire that perceived barriers do not exist, for example a wheelchair user may be able to transfer themselves into a seat, a blind student may have a friend who is experienced in describing visual experiences to them. Treat each situation case by case.
- Liaise with the disability officer. By and large they will be delighted that you are addressing the issue of accessibility and should be a valuable source of information and assistance.

This may seem like a mammoth task for someone who is already overstretched. It is true to say that some of the changes that will be needed will create extra work, either at individual or departmental level, at least for a short while. But many are simple to enact. Many more require systems to be devised rather than material acts carried out, despite the legislative requirement

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Integrating accessibility into teaching

As long as you ensure that ... pathways are equivalent, and that students with a variety of disabilities will be able to access at least one of those pathways without difficulty, then you are likely to be sufficiently accessible

for departments to provide anticipatory adjustments (for example if your department decides that one of its adjustments should be the provision of a laboratory assistant to aid blind students in undertaking experiments, and the only students allowed into each practical class are pre-registered, then as long as the assistant can be called upon whenever required it may not be necessary for them to attend every practical class if there are no blind students registered. However, the students should have been given ample opportunity to disclose any requirements prior to the first class).

One other key fact to remember is that you do not have to provide only experiences that are fully accessible to every student. Such an approach would remove a great deal of diversity and creativity from courses and may lead to the student experience becoming increasingly dull and homogeneous. What the law (and an inclusive approach) requires is that every student receives an equivalent experience to achieve the stated learning outcomes of each part of the course.

Hence, if you evaluate your key course objectives (such as by undertaking a 'Teachability' review (3)), you may discover that there are several ways in which students could achieve those objectives. As long as you ensure that those different pathways are equivalent, and that students with a variety of disabilities will be able to access at least one of those pathways without difficulty, then you are likely to be sufficiently accessible within the terms of SENDA. Obviously the courts will have the final say, but hopefully this piece has shown that inclusive practice need not be a major headache for academic staff, and that many staff will not be required to make fundamental changes to their practices to remain within the law.

References

1. Disability Discrimination Act 1995
http://www.hmso.gov.uk/acts/acts1995/1995050.htm

2. Special Educational Needs And Disability Act 2001
http://www.hmso.gov.uk/acts/acts2001/20010010.htm

3. Teachability Project
http://www.teachability.strath.ac.uk

Further Resources

TechDis: Technology for Disabilities Information Service
The JISC TechDis Service aims to support institutions in providing access for those with physical, cognitive or learning disabilities to learning and teaching, research and administration across FE and HE, through the use of ICT.
Tel: 01904 754530
email: helpdesk@techdis.ac.uk
website: http://www.techdis.ac.uk ■

Dyslexia in Further and Higher Education

Article by **Avril Johnson**, Disability Services, Student Support Services, University of Hull, HU6 7RX
website: http://www.hull.ac.uk/disability/

I qualified as an Occupational Therapist ten years ago and worked for the NHS with children, 0-18 years with physical and learning disabilities and also adults with learning disabilities until 2000.

I became increasingly aware that children and young people with specific learning difficulties were not being identified in mainstream schools and that their problems were being largely overlooked.

The opportunity arose to specialise in this field and it was interesting to move into Higher Education. Here I discovered a climate of acceptance of 'hidden disabilities' and that support services were growing. Many students receive the help they need after years of struggle. There is a huge task to be done in schools, colleges and (some) Universities in raising awareness of staff.

I am married with two sons and studying for a part-time MA in Dyslexia Studies.

The Disability Discrimination (1995) Part IV Education comes into force on the 1st September 2002, only a few weeks before students once again invade our presently deserted campuses.

Requirements of the legislation:

- Institutions must not treat a disabled person 'less favourably' than a non-disabled person for reasons related to their disability without 'justification'.

- **Institutions will be required by law to make 'reasonable adjustments' to ensure that a disabled student is not placed at a 'substantial disadvantage'.**

Thus it is important all university staff are vigilant in detecting indications that a student may be dyslexic or have a related 'hidden' disability. However, in making 'reasonable adjustments' and adapting teaching methods to incorporate the different learning styles of dyslexic students, the aim is not to create lower standards or privileges, but the right circumstances under which they can develop and demonstrate their potential.

What is dyslexia?

Dyslexia is by far the most common Specific Learning Difficulty (SpLD) in Further and Higher Education. However, there is often considerable overlap with other SpLDs and it is possible to be dyslexic, dyspraxic and have attention-deficit disorder.

Many of the interventions to assist dyslexic students discussed herein will be relevant to other hidden disabilities.

There are numerous definitions of dyslexia and many now acknowledge the **individuality** of dyslexic learners and that they will not all exhibit the same characteristics, nor to the same degree. It is important to look for a **pattern** of difficulties.

However, there is broad agreement that dyslexia tends to be characterised by:

- a difficulty in automatic language processing affecting reading, spelling and writing
- a difference in cognitive style affecting learning organisation and memory
- a need to employ different and often more personally meaningful strategies to learn language-based skills
- typically, a history of frustration and failure, especially in school, resulting in poor self-esteem
- but, in the best circumstances, dyslexia is an opportunity to excel

Some presenting features:

- a marked discrepancy between ability and standard of written work
- difficulty getting ideas onto paper, planning and organising assignments, poor proof-reading ability
- difficulties in reading accuracy and poor speed of reading
- problems following a sequence of complex instructions
- a persistent problem with spelling, even common words
- a weakness of short-term memory – facts, references, formulae
- problems note-taking and copying at speed
- difficulty transferring learning from one situation to another
- visual discomfort – headaches, eyestrain, blurring of text, print 'moving', hypersensitivity to screen flicker, bright and fluorescent lights

However, the strengths of dyslexic adults can often help to compensate for their weaknesses:

- good comprehension skills
- good practical and problem-solving skills
- ability to process information holistically
- creative thinking skills
- good powers of visualisation
- persistent, determined, hard-working, resilient
- an intuitive empathy with others

Assessment

If you suspect a student may be dyslexic, suggest they discuss this with the University's Dyslexia Adviser. Most universities are able to offer referral for

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Dyslexia in Further and Higher Education

Institutions will be required by law to make 'reasonable adjustments' to ensure that a disabled student is not placed at a 'substantial disadvantage'

formal psychological assessment, usually financed from the Access or Hardship Fund.

If the subsequent report confirms a diagnosis of dyslexia, special examination arrangements can be put in place such as extra time, allowances for spelling, grammar, structure and, in certain cases, use of a computer or amanuensis. The Dyslexia Adviser will also assist the student to apply to their Local Education Authority or equivalent funding body to establish if they are eligible for Disabled Students' Allowances (DSAs). The allowances can help with the cost of major items of equipment such as computer/printer, and also with tape recording devices and specialist software to, for example, assist with the planning of assignments, with word prediction, spelling and proof-reading. In addition, if recommended, a student may access note-taking support and/or group and individual study skills support. Copies of the relevant reports are usually sent to the student's supervisor if the student is in agreement.

How can tutors and lecturers help?

1. Present your material in a variety of ways:

- **Visually**

use pictures, diagrams, colour coding, highlighting, clear handouts, practical demonstrations

- **Orally**

use explanations, repetition, discussions, tapes

- **Kinaesthetically**

use practical activities, 3-D models, tactile exploration

- **Offer 'right brain' learning strategies**

characterised by use of imagery, drawing, humour, empathy, intuition

- encourage experiential and 'hands on' activities
- develop visualisation skills
- encourage imagination

2. Introduce 'holistic' ways of presenting subject matter:

- Introduce the 'whole picture', an overview, before the parts within. Give 'markers' along the way to help distinguish important points
- Make explicit links from particular examples to the general overall idea
- Give concrete examples (using audio-visual aids or demos where possible) to build up a 'picture' of abstract ideas

3. Discuss the learning process with your students:

Explain why you are doing a particular activity and

- which skills you are hoping to develop
- what information or skill the student is expected to learn
- what the relationship is to other learning experiences

Discuss with students how they intend to go about learning something

- explore which strategies have worked for them
- encourage students to share successful strategies
- develop students' analytic skills to decide why certain strategies work and others are less successful

4. Encourage students to take charge of their own learning:

- consider the use of active learning situations where they can explain or demonstrate things to each other, working in pairs or groups, select activities or projects
- stress self-checking and give opportunity for self-assessment

5. Introduce learning skills through content:

- discuss, define, explain language particular to the profession - common vocabulary, new terminology, jargon
- break down processes into steps with opportunity for feedback to check understanding

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- encourage questions
- demonstrate and explain how to do assignments

6. Offer specific help with:

Note taking:

- make your own notes available
- write main points and terminology on the board
- if using OHPs, label clearly or type, limit the information to main points only and do not talk over them when students are trying to copy them down
- make handouts clear and easily accessible (see below)
- introduce the use of mind maps as an alternative method of recording information as well as flow charts and simplified diagrams

Reading:

- give guidance on selected key works, especially articles/texts that are clearly structured and well presented, to minimise reading load
- identify new vocabulary in texts
- offer audio-visual sources on subject matter if available

Writing:

- explain essay titles or the purpose of the assignment explicitly because dyslexic students often misunderstand questions set
- avoid unnecessarily complex language when writing assignment or exam questions. Avoid long and syntactically complex sentences
- offer models of written work, essays, reports, projects
- give help with planning, structure, organisation. Many dyslexic students are intuitive thinkers - they grasp concepts very quickly. What they have problems with is transferring their ideas onto paper. Their ideas get muddled and this affects sentence structure and essay organisation
- when necessary, allow extensions for assignment writing. When marking a dyslexic student's work, separate marking of spelling, grammar and punctuation from content so that the student's knowledge and understanding is acknowledged and valued

7. Production of materials:

- use coloured paper for photocopies of handouts and materials – ivory is usually widely acceptable
- use a clear font, 'Arial' or 'Comic Sans' is often preferred to 'Times New Roman'
- do not justify right-hand margins. This makes the space between the words uneven and difficult for dyslexic students to follow the print
- using sub-headings, bullet points and clear presentation makes materials easier and less daunting for dyslexic students to cope with. They are also an invaluable resource for revision and assessments

8. Generally:

- make sure instructions are clear
- be explicit in your expectations, clear in your own communications and check understanding
- be aware of the extra time, effort and concentration the dyslexic student needs to bring to tasks involving language
- do not expect the student to remember without extra reinforcement or a secure framework

9. Finally:

- some students can only generalise from lots of specific concrete examples and practice
- when a student makes an error in a sequence you may need to retrace all the steps with them rather than just point out where they went wrong
- some students may be easily distracted by noise, activity or visual 'clutter'
- dyslexic students may need more time to absorb information - break up learning sessions, discussions and activities to allow this processing to happen
- the final stage of learning is being able to 'teach' another - give opportunities for students to do this ■

avoid unnecessarily complex language when writing assignment or exam questions. Avoid long and syntactically complex sentences

The use of C&IT in teaching
from the perspective of the ASTER Project

Article by **Lena Tostevin,** ASTER Project Officer, School of Physical Sciences, University of Surrey, Guildford, Surrey GU2 5XH.

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ASTER was a consortium project funded by the UK Higher Education Funding Council for England (HEFCE) under Phase 3 of the Teaching and Learning Technology Programme (TLTP3).The project was led by the University of York (LTSN Psychology) with project partners at the University of Oxford (Humanities Computing Unit), University College, Northampton (School of Behavioural Studies) and the University of Surrey (School of Physical Sciences). The main phase of the project ran from 1st September 1998 to 31st August 2001. An additional 'transferability phase' extended the project until July 2002.

1. Introduction

The ASTER Project is a recently completed project on the impact of Communication and Information Technologies (C&IT) on small-group teaching in UK higher education.

ASTER's major legacy is a collection of case studies of teaching practices built by interviewing academics of different disciplines. The individual case studies are available from the ASTER website - http://cti-psy.york.ac.uk/aster/, which also comprises other resources that the project has developed. Some of these are introduced below.

- Case studies

Each case study contains information on the teaching context, the motivations for change, the C&IT introduced and the effects on the teaching and learning. A report ('*Investigating the use of electronic resources in small-group learning and teaching*') analyses and compares the various uses of C&IT found and their repercussions. The report also includes the template used for the interviews to allow other academics to write their own case studies if desired.

- Reflective Tools

Based on the interviews for the case studies, ASTER developed a set of reflective questions to help identify the motivations for teaching, pinpoint areas that one wishes to maintain or change, explore how changes could improve practice and identify barriers to change. Called Reflective Tools - as they are a guide to structured reflection - they do not propose to provide answers; instead they aim to help the users develop a clearer idea of what their priorities are for teaching and learning.

- Educational Framework

To help academics rationalise the applications of learning technologies, ASTER has produced '*An Educational Framework for Reflecting on the use of Electronic Resources for Small-Group Teaching'.*

- AskAster

To facilitate the access to ASTER resources and improve their usefulness, the website contains a set of "frequently asked questions" called AskAster. The answers address in detail the implications of using C&IT and discuss the associated problems and benefits. Each answer provides information about the topic chosen, corresponding case study (ies), bibliography examples and links to other sources of information.

- Other resources on ASTER's website are a bibliography, a list of publications and links to similar sites and projects.

2. Findings from ASTER's research

While institutions and national bodies (in particular the Quality Assurance Agency) have general guidelines about teaching and learning in higher education, they are rarely specific about how C&IT is to be used. It seems that, in general, individuals take the decision to innovate to make teaching more interesting for themselves and/or their students, and to introduce new ideas and practices arising from research. At times, however, innovations result not from individual initiative but from institutional policies, as, for instance when a Virtual Learning Environment is adopted for the entire university. A major driving force for change is student expectations, particularly as schools, and FE colleges, are making increasing use of C&IT.

2.1. Tools and Resources

ASTER found that C&IT can support a wide range of student activities and learning tasks across the disciplines. In the Sciences and Engineering, these are mainly subject-specific, and the resources more frequently used are analytical tools and simulation software. In some instances, computer software designed to allow students to practice skills such as performing numerical calculations and formulae manipulation was also used for formal summative assessment and for providing informal feedback on progress. The AskAster questions deal with each type of C&IT tool/resource in detail. Below is a very

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C&IT can enhance small-group teaching in many ways, both within and beyond the classroom

brief summary of some relevant to scientific disciplines.

2.1.1. Simulation Software

Simulations can be used to help students visualise complex concepts or phenomena, or take the form of a virtual experiment. They can encourage discovery learning. To be efficient, however, simulations require the students to actively engage with the activity. Therefore it is indispensable that simulations are incorporated as part of the curriculum.
Several of the Physical Sciences case studies use simulations, "Simulation software in a foundation level Waves & Optics module", "Software aid (Psst!) for optoelectronics and linear optics classes".

2.1.2. Digital Resources

Digital resources are rich datasets of text, graphics, audio, video, and other material made available on CD-ROM or (increasingly) via the internet, often through university library services and national repositories. For example:

- Astronomy data, for example from the Hubble telescope
- Census data
- Literary collections such as Literature Online from Bell + Howell
- Full text newspapers and journals online.

Such large datasets invariably have in-built search and help systems, though these tend to focus on using the tools for research rather than teaching, which has a bearing on how students will cope with the material.

The two Astronomy case studies ("AstroLab: Experimental Astrophysics using C&IT", "Computer Assisted Learning in Practical Astronomy") report the use of datasets.

2.1.3. Multimedia Courseware
Multimedia courseware combines text, graphics, simulation, video, animation and audio to present material to students in an interesting way. It can be a rich and stimulating combination of resources. However, in order for students to benefit fully, careful consideration is required on how to embed these resources into the curriculum. Assessment or data presentation and analysis components may also be incorporated.

A good example is the SToMP software, which was used in the case study "Computer Assisted Learning of Practical Error Analysis".

2.1.4. Virtual Learning Environments

VLEs were developed for distance learning, providing alternatives to traditional teaching situations such as seminars and tutorials, by using communication software to support student-tutor and student-student interaction, and providing access to course materials over the Web. However, practitioners soon realised that these tools could support traditional, campus-based courses.

VLEs provide an integrated collection of features, including creation and management of learning materials online, such as course handouts and simple tests, communication tools, assessment tools, e.g. multiple choice questions and quizzes, and management tools. Tutors usually find particularly useful the ability to follow students' progress.

It may be possible to set up access to digital resources provided by other parts of the institution and institutions may also be able to link student records and other administrative information to the VLE, creating a Managed Learning Environment (MLE).

Only one Physical Sciences case study reported the use of a VLE ("Teaching Introductory Level Physics using WebCT and CD-ROM Software"), but their use is becoming more widespread.

2.2. Does C&IT benefit students?

ASTER's research showed that C&IT can enhance small-group teaching in many ways, both within and beyond the classroom, but it is often difficult to gauge the extent of its benefits to students and tutors. When C&IT is used alongside other resources, it is hard to identify which benefits result directly from it. Concrete evidence that its use leads to improvements in teaching and

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Group dynamics have a big impact on the success or failure of teaching practices

learning is limited, but most of the tutors interviewed for the ASTER case studies considered their innovation a success.

The case studies also highlight, however, issues that should be considered before changing one's teaching, and which may impact on the decision to alter current practice, namely:

- How much time one can devote to the project;
- Personal IT skills;
- The extent to which one can modify courses or modules;
- Access to suitable equipment;
- Support;
- Student attitudes.

Some advantages of the use of C&IT:

- Weak students can benefit more noticeably from multimedia courseware (though improvements may not be so apparent with the most competent or hard-working students).
- C&IT can support the acquisition of key or generic skills, most obviously C&IT skills.
- Multimedia resources can motivate students to study and to more rapidly acquire a familiarity with their discipline. Interactive and simulated models are valuable in explaining complex theories for science courses.

But

- C&IT resources created for a particular course are expensive to develop and maintain and may not be useful outside the department in which they were developed.
- Findings from some disciplines indicate that computer-mediated communication may not always be effective. Group discussions carried out using email or a related tool need close monitoring by tutors, and students may need regular prompting to participate.
- Group dynamics have a big impact on the success or failure of teaching practices.
- Extensive use of digital resources may equip students with the ability to find information, but lead to restricted retained knowledge. This is a concern amongst academics in disciplines with limited use of IT in teaching, though it remains to be proven.

Since developing a new resource from scratch takes time and effort and requires technical expertise (and imagination) it may be a better option to use or adapt software developed elsewhere - there is a large amount of material available commercially or from academia. Care is needed to ensure this meets the exact requirements of the course (or that it can be modified for that purpose), that it is suitable for the existing hardware, etc.

Another issue that requires consideration is whether to use a C&IT intervention before, during, after, or in place of a face-to-face class. A tool or resource effective in a situation may be ineffective in different circumstances. The decision must depend on the purpose of the activity and the C&IT needs to be embedded in the course, matching its aims and objectives, which must be made explicit to the students.

The resources that ASTER has developed can assist in reflecting on the topics raised above. More generally, their aim is to help academics to make an informed decision about whether and how to introduce C&IT in their teaching, by weighing up the benefits against the effort required to ensure successful changes. ■

What's New at the Centre

We are delighted to be welcoming two very eminent educators from the USA during the spring of 2003 as guests of the Centre.

Employability Project

Employability is high on the agenda of the funding councils. All departments are going to be under increasing pressure from funding councils and employers to ensure that their graduates leave Higher Education with a wide range of 'employability' skills. Addressing the employability issue is high on our agenda for the coming year and we have been successful in a bid to the LTSN Generic Centre for funding to run our own project on employability. The project will enable us to collate and disseminate examples of resources and activities which are used within the physical sciences community to develop employability skills with our students. Where appropriate we will also produce physical sciences-specific exemplars of generic resources. We are particularly interested in exploring how such resources are used to support those undergraduates who do not have to opportunity, or take the opportunity, to gain industrial experience. All the resources and publications that we produce will be provided free of charge to departments and will be available electronically via our website. Of course, we will be seeking to collaborate with colleagues with the relevant expertise in order to deliver useful outcomes from this project. If you would like to be involved or think you could offer a case study of how you try to develop employability and career planning skills with your students we would like to hear from you. Contact our Development Officer Della Grice, d.g.grice@hull.ac.uk ■

Annotated Bibliography

Many colleagues within departments of chemistry, physics and astronomy are actively involved in developing new learning resources. From developing and evaluating resources it is often a small step to producing something which is suitable for publication in the literature. Quite often the background research papers are not readily available or easily identified and this can dissuade many scientists from publishing in teaching related areas. With this in mind, this autumn we will be publishing an 'annotated bibliography' of key research papers in research into teaching and learning in the physical sciences. This publication has been complied by Dr Norman Reid and his colleagues at the Science Education Centre at the University of Glasgow. This publication will be available as a searchable web version and as one of our printed Practice Guides and will be available free of charge to all departments. Contact the Centre if your would like a copy. ■

Visiting Lecturers

We are delighted to be welcoming two very eminent educators from the USA during the spring of 2003 as guests of the Centre.

George Bodner is professor of chemical education at Purdue University, Indiana, who has won numerous awards for his work. George has many areas of interest, among them problem solving and the quality of laboratory based learning.

Lillian McDermott is professor of physics education at the University of Washington and has won many awards and published many widely adopted textbooks. She is interested in the improvement of student learning in introductory physics and the preparation of physics academic staff.

Both Lillian and George will be visiting the UK for 2-3 weeks and during that time they will be available to give seminars in department of physics, chemistry or astronomy at no expense to the host department. An invitation will be sent to each department during the autumn. Contact us if you would like to invite Lillian or George to your department. ■

New Development Projects

The following projects, supported by the Centre, are due to start in October 2002. For more details see our web site...

Bridging the Gap
Dr. C. Gray, Teaching and Learning Service, University of Glasgow and Prof. J. M. Winfield, Department of Chemistry, University of Glasgow

Undergraduate Ambassadors
Dr Jim Al-Khalili, Dept of Physics, University of Surrey and Ravi Kapur, Undergraduate Ambassadors Scheme

Widening participation in Chemistry
Paul Taylor, Chemistry Dept, University of Warwick

Identification of critical factors in the recruitment and progression of foundation level students in undergraduate science
David Harwood, Inst for Science Education, University of Plymouth

Problem-based skills development at scientific interfaces
Anthony Curtis, School of Chemistry & Physics, Keele University

Spot Checks in Chemistry
James Keeler, Chemistry Dept, Univ of Cambridge & Malcolm Seddon, Centre for the Advancement of Science & Technology Education, Norwich

Java applets for Physics
John Reid, School of Physics, University of Aberdeen

Development of a synthetic blood substitute for use in Forensic Science
Joanne Millington, School of Biological & Applied Sciences, University of North London

New faces at the Centre

Della Grice is the new Development Officer and is based at Hull. Although currently working part time while writing her chemistry PhD thesis she will be undertaking the post on a full time basis in a few months. Della will be working on new projects for the centre, for example, the new Employability Project which will involve compiling good practice and producing new resources for use in Physical Sciences education. ■

Della Grice

Having worked previously as Secretary for CTI Chemistry (since 1989) and The Chemistry Courseware Consortium (since 1992), Jane Mottram has been providing office support to Centre staff based at Liverpool on an 'ad hoc' basis since the Centre opened. Now her position has been 'formalised' within the group as Centre Secretary, working part-time (0.4fte). ■

Jane Mottram

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Events —2002/3—

- Personal Development Planning, 23rd Oct 2002, London
- Context based learning, 4th Dec 2002, Nottingham
- Personal Development Planning, 29th Jan 2003, Glasgow
- Using the Web to Teach, 19th Feb 2003, London *(provisional details)*
- Forensic Science Swapshop, 19th Mar 2003, Lancashire
- New lecturers event, 10th April 2003, Warwick
- Evolving Science, 7th May 2003, Edinburgh
- Departmental Representatives Meeting, 21st May 2003, Birmingham

Contact us or visit our web site for details.