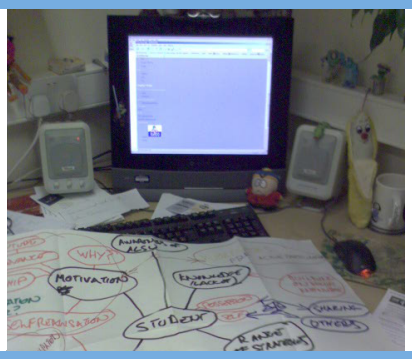
REPORT

Approaches to e-Learning Development in Biosciences





A report of case-study visits undertaken for the Distributed e-Learning Projects

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The Higher Education Academy

CENTRE FOR bioscience

Report

Approaches to e-Learning Development in the Biosciences

Author: Terry McAndrew

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Universities of

Leeds Metropolitan; Trudy Hartford
Sheffield; Alistair Warren, Geoff Cope, Kath Linehan
Essex; Martin Sellens, Nicola Billam, Lucy Glover
Aberdeen; Phil Marston
Massechusetts Institute of Technology[1], USA (M.I.T); Phil Long

Introduction

The Centre for Bioscience undertook to carry out a series of behind-the-scenes case study visits as part of the Distributed e-Learning (DeL) programme, to discover more about the issues of production and implementation of e-Learning, specifically in the biosciences.

Project deliverables tend to show the most positive outcomes of a project and less attention is given to the problems and pitfalls of the application and development of e-learning solutions. Our experience of the behind-the-scenes issues was limited to our host institution (University of Leeds) and brief discussions at events or meetings. The Centre therefore allocated resource to a series of face-to-face interviews in a number of Universities using the Distributed e-Learning (DeL) phase II funding, to better inform its planning and improve its awareness of e-learning issues.

Institutions were selected based on their differing approaches to e-Learning with each approach having implications for both the institution and the individual in terms of the support required, re-use of content, skills, software standards etc. Each example tends to contain elements of the others and the boundaries between the examples are never completely distinct. However, it was felt that together these covered a wide range of useful issues.

1) Four institutions were selected to represent the following;

- **Individual-based,** illustrating development based around a local 'champion' (Leeds Met)
- **Departmental-based externally funded** project, illustrating a step change in practice (Essex)
- **Departmental-based internally funded** re-development, illustrating the opportunities presented by technology changes (Sheffield)
- **Central-based service** e-Learning specialist team projects, illustrating working in partnership with Academics (Aberdeen)

2) In addition

- **International** initiatives – solutions which are scaled for *world-wide application* (M.I.T.)

Method

1. Contact was made with academics and developers known to the Centre for Bioscience through events the Centre had organised, or attended, to arrange a visit to the institution. Discussion was informal but a framework for the conversations was based on the JISC effective practice with e-Learning proforma used for the collection of case studies. The interviewer spent a half or full day in the institution including, where possible, a visit to the actual environment where the e-Learning solutions were deployed. Students using the materials were asked to comment privately on their experience of the e-Learning materials and their value where possible.

2. During Summer 2007, an opportunity arose to visit the Massachusetts Institute of Technology (M.I.T.) in Boston, USA. This was added as a supplementary study and is an example of an institutional approach. The same framework as above could not be applied but where possible, common areas and approaches were covered.

[1] Not funded by the Del project.

Visit 1: Leeds Metropolitan University

Developing e-Learning with a 'local champion'

Contact: Trudy Hartford, Health and Human Sciences

This case study describes the process of design and development of online learning and the implementation of group work using an online environment to optimise valuable contact time.

Challenge and Task

Leeds Metropolitan had selected a Virtual Learning Environment (VLE) for improving delivery and support of full and part time courses to the increasing number of students. The VLE environment enabled combinations of online resource to be brought together to offer delivery that suited the student needs and those of the staff teaching on the modules, in particular the opportunity to improve the quality of contact time with students. Trudy wished to take best advantage of features in an upgrade to the VLE system to address some of the problems found in courses.

Background

Leeds Metropolitan University (Leeds Met) introduced the WebCT VLE had recently upgraded to the WebCT Vista.

Delivery of material through lectures was not necessarily the most effective method for all students, especially part-time and distance learners who found it difficult to attend all the lectures. Tutorials with smaller groups of students were more effective so it was decided to apply the VLE to reduce the hours of lecture time in exchange for more tutorial contact time. Potentially, the VLE could provide an alternative route for delivering the bulk information which was usually a core of the early lectures. Tutorial contact time could also be experienced online. The modules selected had a mixture of student backgrounds and many of the students had placements in distant healthcare workplaces — attending lectures and finding time for working together was a recognised problem. Also, the topics were very well supported by news media with additional online material.

Process - how the work was planned and carried out

Students are supported by a recently introduced portal system (Lumnis based) and consequently are using the online environment more dynamically; updates and notifications are 'live' so the development of online tutorial meetings is a natural extension. Students need online materials which are engaging to encourage them to commit to the course areas and interact with materials frequently. Staff time may then be used to give targeted feedback and comment to student assignment groups collectively, reducing the need for repetition. The online approach would offer a wider resource base, allow more workshops and tutorials and a better means for keeping contact with the tutor – the individual and groups feel more supported. The courses selected were 'Integrative studies' and 'Infectious diseases' at level 2, and Techniques in Biomedical sciences at level 1. The 'Integrative Studies' was written from the outset with the features and advantages of the web in mind.

The students were usually familiar with at least one module in the VLE so 'cloning' the structure and its processes from a current module helped all participants get up-to-speed quickly and establish a common framework. Third-party online resources of topical information were to be included where relevant e.g. Bird-flu, Bioterrorism, GM foods etc. These came from external providers including the BBC and other news services and specialist resources available from other universities (including the Centre for Bioscience ImageBank). Online materials also included support for numeracy self-assessment as student confidence in mathematical skills is a widely recognised issue in the biosciences. An external project involving a few universities under the topic of Maths for Life Sciences had outputs which were suitable for 'Techniques in Biomedical sciences' — not only was this be useful to incorporate but the experience of working with projects such as this, a network of contacts in e-Learning in other organisations can be developed, offering opportunities to exchange best practice in implementation and offer feedback regarding material development.

The tasks for the students included working as online groups to organise and present on a topic from a wide range of current issues which they help to define. Involving the students in the topic selection helps to avoid problems; initial broad aims were narrowed down by the student group through online discussion to allow the members to agree what interests them. This is easy i.e. no technical hurdles, and group momentum is established early.

In the VLE, student activity can be tracked by staff so they can identify where insufficient use of content is being made. In addition, student questionnaires and formative assessment identifies problem topics or problem students early. It has been noticed students can leave it late to declare non-participating members in group projects but the VLE's tracking features help to uncover these issues early and enable the problem to be addressed as soon as possible. Students are also shown how the system can be monitored, so they are aware of the basic metrics to keep up to. Resources not used are discovered through weekly reports.

The use of online delivery and communication liberated time for tutorial support following these changes. Each student project group has its own discussion site which is private to its members and the tutor. Groups are given objectives at the beginning of an open ended exercise to engage them with applying the web tools. Initially, each member of the group is tasked to find a reference for their fellow members. This task checks all participants are active and establishes a little peer competition and ownership within the group. All group contributions are collated by the tutor so each contributor receives approximately 30 references for their single contribution. The tutor comments on the value of the references.

Students contribute to discussion online: fellow students select the best four postings to the discussion area which are assessed against 'essay criteria'. The mark is a small percentage at 5-10% (to lessen risk) but large enough to make the activity worth the effort. Each week the minutes of their group meetings must be posted. Each group has a limit to the amount of tutor time - a different tutor available for a maximum of 2 hours per week, to prevent over-use or dependency. Module objectives and learning outcomes are consistent each year but topics are updated. To ensure the materials are visible, all staff have access to a VLE student account to enable them to check how content appears.

At the end of the module, students hold a face to face conference and present on their selected topics. Final student outputs are gathered and added to the resources. Students moderate contributions to the finished work within their group and, as much of the work is co-ordinated online, evidence of relative effort is available.

The Dos and Dont's

Following the experiences with the VLE environment and such a diverse range of students, a number of key points are recommended for courses which use online materials and delivery systems in this manner.

Control

- Establish control mechanisms: an early session about group working is given so students learn how to collaborate effectively.
- Manage expectations: be strict on letting students know when their messages will be read so expectations are clear and students know when to post effectively.
- Clarify Restrictions: students are less clear on the relative quality of online resources with respect to journal articles and need advice on popular sources e.g. WikiPedia or restrictions.

Support

- Pay attention to the student needs: use of the Web facilitates more feedback. Tutor feedback obviously, but other members of the group give significant contributions. Tutors 'pop-in' and prompt occasionally.
- Be current: pick topics which are current and well supported by online media – give scope for discovery. Topics which are perceived to be 'gathering dust' are less engaging.
- Build on skills: the module incorporates a group skills umbrella. Practice expands this and increases the pool of talents in the group e.g. report writing.
- Build on other projects: blend external projects into the materials where relevant.
- Ensure marking is objective: quality of references, clarification of aims, minutes, progression and discussion evident. Groups which work well are easily noticed (and those that do not).

Delivery

- Ensure quality of materials: external video resources have to be selected from trusted sites.
- Utilise other resources: skills freely available and value them within the module e.g. critical evaluation
- Make the interface friendly: it is worth the effort to help engage the students.
- Extra materials: have a selection of external resources to cover the topic but allow redundancies.
- Communicate effectively: include humour, carefully.
- Test: Use formative testing and provide it during the revision period.
- Be up to date: take advantage of what the technology offers; students will notice when features are not used.
- Beware of security concerns: some topics (e.g. bioterrorism) are sensitive to security issues and this may affect access to the resources
- Keep it very simple

In addition to the standard processes for module evaluation and quality control within the organisation, the project provided sufficient material to publish both internally and externally. The University operates an in-house teaching journal which provides an opportunity to publish short articles. Longer papers may be published through the Bioscience Education e-Journal published by the Centre for Bioscience.

The following points were problem areas which were difficult to avoid but can be circumvented with adequate preparation.

- Part-time students usually have personal computing resources on broadband networks but some rely on their work-place facilities to support their studies. For some students their network's firewall prevented access to video-streamed resources but the redundancy and duplication of materials in other media reduced the significance of the problem.
- Time – it takes *even more* than expected. Even experienced practitioners skilled in the software tools need to allow more time than expected. The overhead in preparation for online delivery, especially the first 'lap' of the course, is significant and can have some dependencies on 3rd parties for software upgrades, version changes etc. Plan for extra time when developing such courses.
- Resources going offline are rare, but it does happen. Each lost link is disappointing for students and de-values delivery. Monitor the availability of resources during the module and do not rely on students to report these. Many will carry on past the problem

without taking the trouble to alert the module manager and save other students the trouble.
- The large scale VLE systems benefit from integrated management from student administration record systems. However, delays in registration will occur so a mechanism for direct registration into an online resource can be essential. Part-time students can have other delays.
- Once established, students will expect this standard from every module. Students can play-off one staff member against another; each innovation raises the skills and techniques bar for other areas of teaching.

The benefits of this approach

Developing e-learning material as an individual academic is common in the biosciences (and probably academia as a whole) because it removes dependencies on other 'external' factors and improves the individual's skills and competencies. In Trudy's role as a local contact for Personal Professional Development (PPD) these skills can be passed on to other colleagues if properly supported. Funding time for her to do this was provided as part of her teaching fellow role to use approximately 100 hours for local staff assistance and development using short 15 minute sessions almost on-demand. This helped other staff make immediate changes to online content with a trusted colleague, familiar with the context of the material, while the advice was fresh. The institution's Learning Technology Centre supports general materials but Trudy can provide discipline specific experience to her colleagues.

These modules take advantage of the main delivery system, WebCT, and the students are confident the experience will serve them well for other modules. The features used are based around the module needs and not just used because they were part of the software. By supporting colleagues as a trained local expert, Trudy gives ready access to context based support for the more advanced features leading to faster adoption of the facilities thus lowering the barriers to engagement for all staff and making the learning and teaching more enjoyable for all concerned. Time is saved through re-use of 3rd party materials and a single developer with few dependencies. The skills gained are made available to local colleagues quickly through the formal support network.

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Hartford T (2006), Computer based feedback – friend or foe. *ALT resource Assessment, Learning and teaching Journal* available at http://www.leedsmet.ac.uk/ALTresource/incubator_journal_issue1.htm (accessed April 2008)

Visit 2: University of Essex

Developing e-Learning Through External Project Funding: the Student Portal Resources for Innovative Targeted Assessement (SPRInTA)

Contacts: Martin Sellens and Nicola Billam

This case study describes the design and development of targeted formative feedback using a combination of sytems which had to be integrated seamlessly using a number of services, requiring a team-based approach. This was carried out using external project funding.

The learning lab at Essex. Workstations are grouped in a comfortable suite with walls suitable for projection or annotation.

Challenge and Task

Increasing student numbers and consequently more unfavourable staff/student ratios were identified as likely to adversely affect the support of the students particularly with respect to assessment and timely feedback. Staff were aware that software solutions were available on-campus to tackle this problem if properly integrated. It was clear there was an opportunity to use the new portal facility to offer targeted assessment materials for specific programmes of study by linking the student record system with the assessment system and then utilising the WebCT virtual learning environment.

The requirements for the project were identified by members of staff in a subject discipline – Sports Science. They realised that the level of development would need significant funding above the usual local funding initiatives available on Campus and were made aware, through the Higher Education Academy subject network, of a suitable initiative. The team successfully bid for £132k from the Higher Education Academy as part of phase 5 of the Fund for the Development of Teaching and Learning (FDTL), to develop innovative ways to tailor learning resources. They used a combination of their new portal system with the QuestionMark assessment system. This enabled them to create links between individual student performance/ assessment data and appropriate resources in the campus VLE.

The project sought to provide timely feedback to more students while reducing the workload on staff. Measuring the performance of the student using IT enables specific support materials to be presented to the student immediately after results are known. Students are made aware of areas they should work on making the feedback more useful and the next set of learning materials becomes more useful or relevant. It was also hoped to improve student retention, as students become aware of their difficulties earlier.

Online formative assessment promotes a deeper understanding of the basics of the course material and has been recognised as useful to low-attainers as they are made aware of problems and issues to address. It also supports independent study and the experience (for academic and student) provides a foundation for use of subsequent summative online assessment.

Formative assessment opportunities in current modules were limited. The previous practice was becoming inefficient and less likely to meet the increased demand on staff time. Online assessment was already established in existing courses using question banks so some skills were already in place. However, more formative content was needed to build a pool of usable questions across many more topics.

The Student Portal Resources for Innovative Targeted Assessment (SPRInTA) project began in November 2004 and took 22 months to develop.

Background

Essex University is a modern campus with almost 8,500 students and has developed innovative teaching spaces for integrated activities with Communications and Information technology (C&IT) as shown in the 'iLab' above. Like many other universities, Essex has recently implemented a Student Portal to support a more diverse student population. Students have access to PCs on campus but off-campus use is also widespread. Students are familiar with web-based resources and, as these are now more available for use off-campus, the project sought to take advantage of this.

Process

The production of suitable MCQs would be expensive in terms of staff time but it was felt that around 600 questions would be needed to cover the essential topics adequately. These would be supplemented with short answer questions. Specific attention would be paid to data analysis and interpretation, supporting practical coursework and reporting in a scientific format.

Work was divided naturally by the pool of talent available and regular meetings (monthly and termly) were sufficient to keep the project on track. External evaluators were appointed to advise the project group. Student focus groups (with incentives) were formed to give feedback and advise developers of any issues.

Delivery needed to be controlled; blocks of questions would be released each week to keep the requirements and expectations manageable – too many questions presented too early were likely to be a disincentive for deeper study. All content would be guided through the University portal, giving a single entry point. Levels of question ('basic', 'threshold', 'advanced') were defined to enable appropriate feedback on performance and challenge the students appropriately.

A pilot was initiated to identify course materials and learning outcomes that each student should know for the fundamentals of the course. A threshold level (TL) outcome (the essentials required to obtain a degree) was defined in five topics. The pass rate would be set at 80% for these TL outcomes. Modules selected included Human Physiology, Evolution and Biodiversity, Structure and Function of Carbohydrates, Lipids and Pharmacology.

Online delivery is available 24/7 and hence the MCQs are always available, enabling the learner to take control once a very short initialisation session has been undertaken; the students appreciate this flexibility. The major components of the system (Portal, question bank content & delivery, and the VLE) can be maintained independently without disrupting the whole service thus avoiding single service dependency. The questions are periodically monitored for performance to improve the resource using established metrics, in addition to an annual periodic review.

The coordination of the portal and the assessment system required many technical challenges to be overcome for the students to get the appropriate tests at the appropriate time. This required the SPRiNTA group to run a version of the Question Mark Perception assessment system (version 4) which was more advanced than the University-wide service (version 3) to enable the authentication system to work effectively with the portal. It should be noted that question bank content can be exchanged between systems using IMS Question and Test Interoperability standards (QTI) thus enabling the question resources to be re-used and enable the future addition to the question bank from external sources.

Student uptake for the project material was favourable. 85% of students used it and 95% of those who used it, liked it. The performance improvement in the summative MCQ exam was significant ($p<0.05$) and 96% of the first year students expressed a wish that other modules should have similar SPRInTA formative assessment support. The highest demand was in a short period prior to the exams where its value as a revision aid was greatest. Future presentations of the modules are looking at ways to encourage earlier usage of formative assessment.

External evaluators involved in the project during construction were drawn from subject specialists, computer assisted assessment and portal developers, reducing the need for major work at the end of the project.

The Dos and Dont's
This project needed to integrate a number of systems, managed by staff in different teams, to deliver targeted formative assessment effectively. The following points were regarded as key for delivering the project:

- Technical skills: a project such as this must have ready access to appropriate technical skills to ensure the elements are correctly configured and implemented, sometimes creating *ad hoc* code to bridge the services.
- Collaboration: good collaboration between key staff is vital where a project involves three key groups – local academics, the Learning Technology Unit and the University Computing Service. Each had further uses of the project outcomes and could therefore commit resource in the knowledge that wider applications of the project solutions were likely to follow. However, expectations must be consistent between groups.
- Scale: start small and build up from scalable objectives
- Evaluate during development: large projects need to be carefully planned and implemented while being sensitive to the environment they are delivered in. By building in evaluators during the development of the project, the final product is made more fit for purpose on delivery.
- Incentivise: a (minor) proportion of the content in the formative assessment was to be re-used in the summative assessment. This encouraged students to take part early in the project. Having an unlimited number of formative attempts encouraged practice.

Local discussions revealed that some non-bioscience disciplines were suspicious of the value of MCQs being used as higher order learning was more difficult to implement. This was taken into account during question development. It was also noted that engaging students in formative assessment was more difficult than expected and this is to be studied in future work. The number of modules which actually applied the project was less than initially expected but this supported the 'start small and build up' approach. By reducing the number of modules initially, greater support could be given to the remaining ones in the longer term.

With all major IT projects a significant number of unknowns exist at inception which are subsequently discovered during execution. Based on these experiences a number of tips are suggested:

- Work with the infrastucture – don't compete against it! Be aware of the infrastructure strengths and weaknesses and make few assumptions. It is important to be aware of software dependencies in any project but where these are ones used across the institution they are likely to be less flexible. Changes take longer to make on large scale services. Be fully informed when other dependencies change as they may be significant services you rely on – have an alert or notification policy prepared to flag changes early if possible.
- Migration issues are often non-trivial when moving to a new version of the same software – allow sufficient time.
- Appreciate that your project may be the one that discovers deficiencies in other infrastructure.
- Short projects have specific problems – part time or contract staff are likely to look for other posts before the end of the project, so allow sufficient time for 'wrap-up' and dissemination activities.

The benefits of this approach
This project met a number of needs; the students were aware of their performance level early, and could respond quickly, and the staff built a resource which would save valuable time in the future. The solution utilised standards for technical integration between systems which passed on benefits to the University as the project piloted many of the issues. The use of IMS QTI provided a transferable resource for other projects of this nature.

Using a large-scale project fund provided a significant dissemination component for a wrap-up dissemination event and presentations at other events, including the international Computer Assisted Assessment Conference. This raised awareness of the implementation issues and the content. The question banks were made available to save time for similar courses elsewhere.

Additional information
The assessment question bank is available for use in other systems at other sites in both Word and IMS QTI format.

Contact SPRiNTA at http://www.essex.ac.uk/sprinta/

Visit 3: University of Sheffield
Developing e-Learning with Respect to Technology Changes

Contacts: Alistair Warren, Geoff Cope and Kath Linehan

This case study describes how an established in-house Computer Aided Learning system was developed into a web based resource for use both on and off campus and explore various teaching styles.

Working with IT at the University of Sheffield

Challenge and Task
The Department of Biological Science had a long history of using CAL materials which, although popular, could be made more widely available to students following recent technological developments in broadband, Virtual Learning Environments and media software standards.

The university had improved facilities in WebCT. New features in this VLE would enable existing lab-based CAL to be migrated to a web based experience which was more accessible to more students at any time. Existing modules were selected for conversion and further development, including Quicktime based videos, microscopy slides and images.

Formative assessment had been a key driver for active student participation, both online and within the practical course. The Anatomy module had used a weekly quiz model to help keep students 'on track' in addition to periodic summative assessment, based on the same content delivery system and applied under controlled conditions. Material from the former projects could now be moved online to Web-based delivery and control through the VLE.

An earlier project (ReMUS) had been a foundation for developing skills and experience in CAL at all levels. This was pedagogically sound and a recognised strength reported by the QAA process. Migrating and developing new materials based on this original content would provide:

- students, on and off-campus, access to what was once restricted to local facilities;
- better monitoring of resource usage. Use of access data could help identify where development effort was required; and,
- a pool of materials for flexible re-use in many modules.

Background
The department of Biomedical Sciences at the University of Sheffield was an early adopter of e-Learning and later, the WebCT VLE. Many of the innovations and developments in the application of online learning support in the institution have come through developments from projects within Biomedical Sciences. Initially a grant of £35,000 for the application of C&IT in Biomedical Sciences in Medicine funded the early use of WebCT.

The original key project in Biomedical sciences, called ReMUS, was primarily for teaching histology to medical students. This was funded by the institution's curriculum development fund, a strategic initiative to secure good practice in the application of IT which provided a good grounding for the movement to WebCT based support.

The initial projects in Biomedical Sciences worked with the Media Services Unit on campus. Advances and demand for e-Learning support within the Media Services led to this becoming a specialised interest within Media Services, leading to the Learning Media Development Unit's (LMDU) formation.

Process
Existing resources had to be converted for the WebCT environment. These were a natural extension of the departmental development in CAL therefore no significant step change was needed, other than that provided by the improved campus infrastructure.

Further 3rd party resources from online service providers had to be evaluated; the intention being to be incorporate them where they provided significant advantage over in-house development at reasonable cost e.g. APERIO digitized pathology, a product which uses a 'Google Earth' type tiled image database interface of slides, instead of a satellite view. Excellent sites in US universities (Harvard and Philidelphia) were identified but the potential dependencies and costs appeared to be an expensive way of losing control over development. For example, a year's license for NetAnatomy (NetAnatomy.com) is approximately $1500. Whilst the Web held a tremendous wealth of potential resources for modules it was still difficult to discover the useful ones – it was described by one staff member as "like a huge new supermarket – everything is available but hard to find".

Each module has its own specific needs but a simple scheme was felt to be the most effective: CAL bases on activity or CAL based on material i.e. support for personal and group work, or interactive materials and demonstrations with visual resources and text.

The Learning Media Development Unit (LMDU) were involved early, funded by an internal grant. Employing the LMDU for a project keeps valuable e-Learning development skills 'in-house' and also imposes realistic controls and guidelines. Biomedical Sciences has enjoyed a good working relationship with LDMU.

Independent 'individual' e-Learning projects are still possible within the organisation but these opportunities are diminishing; grants for resources are only awarded if the LMDU is involved to some degree so that necessary guidelines and consistency can be applied. LMDU also has roles in evaluation and dissemination. Each project must have an evaluation plan and periodic reports (perhaps a project blog in the future). The control has a 'light touch' but contact is frequent and managed. Applying for LMDU grants is time consuming (2 phases) but the overhead has been recognised as valuable for improving quality of e-Learning materials.

The adoption of broadband by the student community has liberated the delivery of complex computer based materials into off-campus locations. Software standards have become established and previous restrictions have been eliminated by conversion of content into more popular formats e.g. Quicktime® video or Adobe Flash®.

Dr Kath Linehan had returned to work at the University after a period in secondary school education. Kath had been a science teacher and this was seen as an opportunity to bring aligned practice in schools into the department. Kath was interested in looking at serving different learning styles with the widening participation agenda in mind. Opportunities for helping a diverse range of students appeared to be available via online materials.

The course selected was a level 2 endocrinology course (BMS205) working in conjunction with Professor Alistair Warren. Kath wanted to get an idea of the learning styles used by the cohort then support/incorporate them in her teaching as her part of six lectures in the course. Kath's model for learning styles was not the typical auditory, sensory, kinesthetic, visual etc.; she was interested in the Howard Gardner model of multiple intelligences. Examples which might typically apply in the Bioscience modules were;

- Linguistic – use of spoken and written language
- Logical-mathematical – analytical skills
- Interpersonal – working effecively with others
- Intrapersonal – self perception and motivational skills

Kath surveyed the learning style preferences in the student body and ensured each was addressed in the teaching activities including lectures. These included 'matching' activities, '100:1' (game show model) quiz for a prize, and 'student vs audience' – each done with exam standard questions. This approach has been carried over into the e-Learning activities e.g. drag and drop labels on diagrams, video with questions (more of a quiz than a test) including student videos of opinions where the user has to select which opinion they agree with i.e. non-threatening. Kath recognises that technologies like Flash® (cartoon-style) based applications are potentially very powerful, but in practice they can be limited: Flash delivered from the WebCT environment does not easily return valuable statistics for monitoring its use.

Geoff Cope, the lead developer of many of these CAL resources, was keen to provide a resource with rich feedback that could be supported in the labs by untrained demonstrators. The lab suites had 16 study bays for Physiology and Anatomy where microscopes, computer and microscope slides could be operated together. He also valued the message boards and feedback that could be posted promptly through Sheffield's student portal system - MUSE.

The University of Sheffield has an extensive feedback system to improve the student learning experience. Students are encouraged to feed back experiences through course teams and the student reps at departmental level as usual (at least once per semester) but the aggregated feedback on many modules is also discussed with the Student Union Education Officer (employed by the student union) who can feed into evaluation and development at faculty level. The Education Officer (Emily Savage, 2007-08 officer). reported demand for off-campus access to learning materials is increasing and is a common request within surveys.

An interview with a 2nd year biomedical sciences student representative supported the Education officer's comments: she told me that the online anatomy facility was regarded as very valuable (especially with exams or resit papers). The amount of time she personally spent on a typical module (probably half of the courses suggest using e-journals and research papers online) would be 1-2 hours per day, probably 8 hours off-campus within a given week as opposed to 4 hours on campus, as time between lectures was limited even though the facilities are good. She felt most students have adequate access bandwith through broadband. Suggestions for improvements to the course teams were given by email or direct conversation. The campus portal (MUSE) allows other student comments to be circulated and gathered. For example, when lecture notes were not coming up online, a MUSE discussion alerted staff members to fix the problem quickly. Anonymous accounts were not necessary as both provider and receiver were comfortable exchanging constructive criticism. Her experience of the online materials was that they were really valuable to help the jump from A-Levels to Higher Education – reading lists, help topics, lecture notes instantly available etc. Student skills in use of e-journals was increasing and she noticed e-journals were gaining a higher profile in research publications because of their increased availability. She did not feel the online material was restrictive in any way. When

asked if she would like to produce e-Learning materials herself she was confident that she could, given adequate support and training, but the risk was that it might be too distracting an activity for her!

The Dos and Dont's
The work in this project is really a collection of incremental improvements of existing materials, with a significant upgrade (in terms of the delivery platform) providing opportunities to develop and review the materials in the process. The following points were important to bear in mind:

- The 'front-loading' of developing materials, i.e. the significant preparation time, for e-Learning is a heavy workload and this is often not appreciated by those outside the project.
- Start small and build up — break down the activities into mini-projects.
- Re-use of shared content theoretically saves time – if the resource can be found. Do not rely on finding what you need easily. Incentives for bioscience e-learning material providers to share their work appear to be lacking as external resources which are ideally fit for the purpose are hard to discover.
- Integrate materials and activities to give the resources context.
- Off-site materials appear less valued by the students. Try to be inclusive and bring these within the project system if possible or 'skin' it to appear so.
- Consider risks - be aware of your dependencies on other technologies outside your control.
- Dissemination outside the organisation is difficult if the environment differs significantly. Whole system 'clones' are not realistic but small components could be potentially shared, if a simple solution was available.
- Context is vital: The materials can be used standalone but integration into the teaching activities makes them far more productive.
- Use local dissemination routes - Sheffield has Teaching and Learning Support Unit 'Spotlight' activities for on-campus projects.
- Allow sufficient time – and then a bit extra.

The project team commented that the nature of material can be an issue with respect to Anatomy and recent legislation appears to have reduced the pool of materials. A lack of resource databases was noted and developments here would be welcome. However, such a resource base needs to be easy to browse and should support a free text search – pedagogic vocabularies tend to be geared towards cataloguers and librarians rather than end-users and this may discourage use. Video and image resources are often poorly described and need to have good descriptive text with possible Amazon-style reviews for resources (e.g. comment from academic peers) or professional annotation. For examples, visit the Centre for Bioscience Image*e*Bank

The style of presentation of the material was found to be more important than expected and early platforms were not sufficient – they needed 'branding' with departmental style to help adoption. Integration into the course structure was vital as standalone resources were not utilised unless bound to a taught or assessed activity. External content should be included within the umbrella of the e-Learning material in a consistent fashion to appear as one application otherwise the resource may appear fragmented.

In conclusion they recommended it was important not to take developing online materials on lightly: it can be very time consuming. The lack of large scale resources, such as a catalogue of components, to support individual 'focussed' development of teaching materials is noticeable and this is a difficult problem to solve.

The benefits of this approach
This scenario is one of continuous development based on sound pedagogy with re-development of existing materials. The improvements in the online VLE environment can provide many opportunities for existing materials to be migrated into a more accessible system, once appropriate technology standards have been agreed. Off-campus students have high expectations for the off-campus experience and are more used to on-demand support for their studies.

By taking into account the Institutional standards and policies for e-Learning projects, and taking advantage of the learning media development unit, the quality of the deliverables is managed and the pool of skills is developed beyond those of the original authors.

Additional information
Department of Biomedical Science
http://www.sheffield.ac.uk/bms/

MUSE (My University Sheffield Environment)
http://www.sheffield.ac.uk/cics/muse

Visit 4: University of Aberdeen

Using a Central Specialist Service for Faculty e-Learning

Contact: Phil Marston

This case study describes a project to build e-Learning resources by using specialist 'in-house' contract developers with advanced software skills beyond those acquired by the average academic who typically develops their own material. This different approach illustrates production of materials for e-Learning using project management, knowledge elicitation techniques, software development, and a thorough process review (in addition to academic review).

Using the online 'wet-lab' practical material

The Challenge and Task

Students with diverse educational backgrounds, studying environmental physiology in year 3, had a 'wet practical' that used the fresh-water shrimp *Gammarus duebeni* to explore sub-lethal copper toxicity to the environment. The experiment was very time consuming both to set up and run. When the course was reviewed it was decided that this lab time could be used more effectively. The parent course ran over 6 weeks using three practicals (with the support of experienced staff) and three 2-hour lectures.

Increasing student numbers (90-120) were placing greater demands on staff and ageing lab equipment. The replacement of the experiment with an interactive and sophisticated simulation, fully featured to give a realistic 'wet-lab' experience, was theoretically possible but would require specialist development skills.

The experiment to be replaced involved animals; it had produced a realistic experience but often unreliable results.

Wet-lab experiments take a long time to run and students become bored if results take too long to gather. The practical was a necessary component of the course but not engaging enough for some of the students. A greater awareness of undesirable aspects of animal experimentation also raised the expectation of the students for alternatives to using live creatures (the freshwater shrimp *Gammarus duebeni*) to explore toxicity of sub-lethal copper in the environment.

A frequent observation was that some members of groups did not participate in experiments and some groups produced very poor data that could not be used by the class as a whole.

The proposed computer-based experiment would have to demonstrate the essential features of the practical and add further features to show 'value-added' from the adoption of IT. Together, these included:

- Personal responsibility – ownership of the process and its results.
- A reactive environment – 'real life' does not involve clicking the 'next' button, so the experiment should relect this.
- Reproducibility
- Datasets that are extensive, representative and unique.
- Fallibility – experiments can and will go wrong.

It was necessary to develop a new learning environment, based on the best of the old 'wet-lab', and with the functionality offered by the more recent web technologies. By keeping the best parts of the practical and generating realistic and useful data each student could participate in a meaningful experiment.

The skills base for the organisation needed to be kept up-to-date with potentially useful technologies and Flash® had been identified as a suitable platform for interactive simulation development.

Furthermore, students who missed the original practical through illness etc., could be given another opportunity to participate.

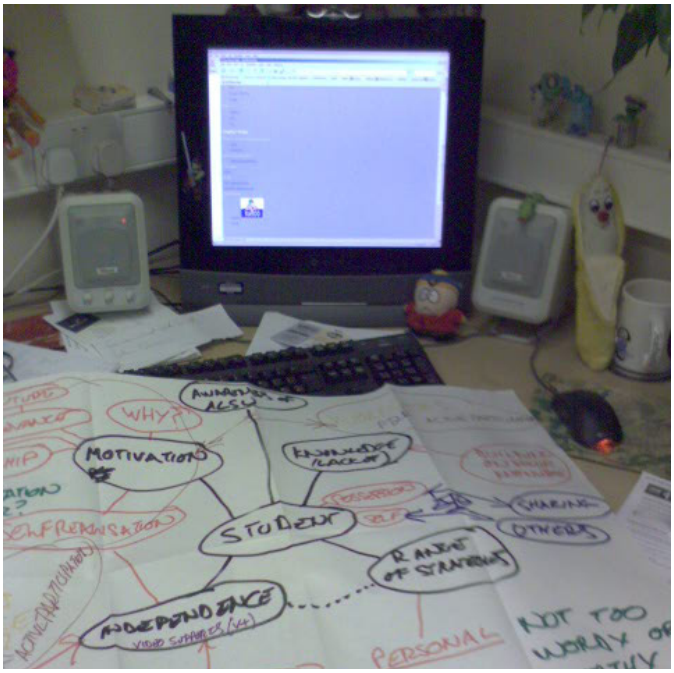
Background

The University operates a central service model for the provision of specialist e-learning developers. Departments are invited to bid for Learning Technology Unit (now in the Centre for Learning and Teaching) time; proposals are received from any academic with support from his or her head of school.

The Process

The central Learning Technology Unit (LTU) scopes its projects using a series of meetings with its academic clients. Knowledge elicitation techniques are used to isolate the key issues and elements of the project to identify and agree the Critical Success Factors (CSFs) that must be satisfied and the supporting elements necessary for the solution to be effective. A number of diagrammatic techniques are used to illustrate these before the programming can begin. The expectations are clear to all parties in advance so that confusion and mismatch are avoided. The LTU carry out all the work using a project based methodology involving regular meetings with the stakeholders. All planning and design is carried out by the LTU based on a function specification gathered through knowledge elicitation and modelling with the client department. An agreed

timescale ensures delivery on time – the need for additional fixes beyond the delivery date are reduced to a minimum by rigorous analysis of the problem. Skills developed for each project are available for the next, thus increasing capacity within the system for more advanced challenges.



The materials developed have met the challenges for the practical and are used more frequently than standalone software: many students now have broadband access and can preview the material before the practical classes. In addition, the opportunity for follow-up after the practical session is available to reinforce the outcomes and re-play the experiment for revision purposes. The 'wet lab' experience has been preserved as much as possible but without the delays and unreliability of the original equipment. The use of advanced Flash® solutions has enabled the experience to be as realistic as possible i.e. extended datasets which are unique for each student. By developing a parent virtual labs framework which is content agnostic, future projects are already part-developed - only the content needs to be added

The Dos and Dont's

This project has a central service model for creation of the materials but it received feedback from the 'client' which enabled minimum maintenance and was of benefit for future projects. The following key points were made:

- Plan the project thoroughly using rigorous techniques to define the specification. This avoids 'feature creep' (new requirements appearing during development) that might move the project off course.
- Communicate project developments in frequent stages to the project sponsors.
- Ensure the output targets are realistic and agree expectations.
- Utilise common technological standards.
- Minimise maintenance - avoid 'firefighting' at all costs
- Test with students who have experience of the previous experiment that this solution will replace.
- Have a clear exit strategy.
- Sign off on completion.
- Provide quality support documentation.
- Give students a unique experience i.e. create a novel dataset for each group.

Student feedback is obtained within the faculty course evaluation but separate evaluation is requested by following the introduction of new LTU materials. This includes anecdotal feedback from two separate student cohorts and this reduces the risk of developing a solution which only matches the LTU programmer's and academic's needs but not the students learning requirements. The project was disseminated through various events and publications in addition to the LTU showcase website. As usual, a number of problems were discovered during the lifetime of the project but the adoption of a project management methodology minimised these.

Issues that arose included:

- Students were used to software features and expect more time acceleration (to an unrealistic extent); even though the considerable delays in the wet experiment were removed the student could still be bored because the expectations were raised.
- Printing problems due to technological incompatibilities within the Flash application framework (the software development tools oversold their promise for a while). This was a consequence of the project being close to the development frontiers.

Future development

The case study visit concluded with an extensive discussion of the developments in the Flash development platform and the comprehensive support network available over the internet. Phil and his colleagues have high expectations of the Adobe Flex development environment for building Rich Internet Applications (RIAs) and Desktop applications. These are applications which run over the web and need little installed software other than a web browser and its popular extensions.

The Benefits of this approach

The advantage of a central pool of developers who are familiar with design, analysis and project management techniques is that this arrangement significantly reduces the overhead for academic staff in faculties without them losing control of the desired output; each specialist can focus on the needs of the client. The institutional approach gains from a cross-discipline influence which can be brought onto the design methodology and resource re-use. Controls for leasing a pool of developers to departments ensures that all materials are produced within a quality framework which meets the standards and expectations of the organisation and its students. Successful dissemination of the project outputs through appropriate networks, e.g. HEA Subject Centres, raises the profile of the organisation and its developers.

Additional information - LTU Showcase: http://www.abdn.ac.uk/diss/ltu/projects/showcase.hti

Visit 5: Massachusetts Institute of Technology (M.I.T.)

A World-Wide View

Interview with Phil Long, Associate Director, Office of Educational Innovation and Technology, M.I.T., Cambridge, Mass. USA

The STATA building at MIT

An opportunity to visit MIT in Boston, USA, occurred following the fourth UK case study visit. This provided an ideal opportunity to compare approaches in the UK with one of the world's most influential educational IT project communities. A number of recent MIT projects were discussed.

Background

MIT think globally – it is part of the organisational culture: All its solutions should have a global benefit if possible. This approach helps clear obstacles in the short term and aids maintenance in the longer term as the problem is analysed deeper from the outset; not only will the problem have a robust solution but the results should produce a scaleable outcome which can enhance the reputation of MIT. In an environment where resources appear to be less of an issue, MIT may be able to indulge in blue-sky research and develop new frontiers. Applications (and their software code) produced by MIT projects can often be used by commerce, at low or no cost, to be further developed into marketable products so the idea itself gets the benefit of the service industry to propagate it.

A number of projects of interest to the Biosciences are *briefly* described below to give a flavour of the approaches adopted at MIT.

Open Wetware

Biological research labs around the world need to share information, knowledge and wisdom in an authenticated system as quickly as possible. The development of Wikis (rapid-build user websites) has enabled a ready solution for sharing lab techniques and protocols by lowering the technical barriers. The wiki developed at MIT was a student built and driven project.

Research labs are registered on the site with a view to developing online and real-world networks. Members make 'parts', similar to engineering projects, which are assembled into complete protocols for solving specific problems. (iGem 2006). This approach addresses the research-teaching nexus and increases permeability i.e. communication across the boundary of the organisations (a strength of MIT). The project aligns with information exchange standards proposed by the Science Commons to accelerate the research cycle and share without penalty (Science Commons, 2006). The proximity of major internet-scale projects on campus is a significant convenience.

iLabs

ilabs are online laboratories (http://icampus.mit.edu/iLabs/) that are designed to give the real experience of using a lab, not a lab-simulation, and its problems. The initative has been developed as part of the MIT-Microsoft Alliance iCampus programme over a 3-year period to explore the potential educational value of Internet-accessible laboratories.

By moving labs online, the range of available experiments can be increased by providing a wider range of equipment which is used more efficiently. Students in other institutions can schedule lab time with equipment their host might not normally afford. Classes in other time-zones can use the equipment when not locally in use. Students get experience of real-time failures too, and learn to plan more effectively. Setting up equipment can often take a great deal of time e.g 20 minutes to set-up a test which might generate results in seconds. By brokering the service through software, the users spend the set-up time remotely; the device receives the parameters as a pre-prepared batch and is instantly ready for use.

The key element is the iLab service broker. Through this interface students can 'book' time and set parameters for experiments. The 'trick' is the interface design.

MIT's role is to provide the technology to interface the equipment, but delegate the control to the remote institution. Successful implementation may provide a 2nd year student with experience of real-world data that they would normally not be able to gather until their 4th or 5th year. It is expected that pharmacology will be a suitable area for a future iLab - currently ilabs are being used in microelectronics, chemical engineering, polymer crystalisation, and structural engineering. MIT have significant resources for 4,000 undergraduate and 6,000 postgraduates, including a nuclear reactor which could be accessed for (limited) experiments online!

Lecture browser

The reduction in disk-based storage costs, coupled with the development of web 2.0 technologies for sharing, has led to the increased use and distribution of video of many activities, including the lectures. However, recording videos of a lecture is not very efficient unless the lecture is indexed and transcribed; users need to move to the appropriate part of the presentation quickly and easily. Transcription, unfortunately, is very time-consuming and therefore an expensive process. Services which automatically translate podcasts are available on the Internet, notably Podzinger and more recently from Everyzing. However, educational recordings are difficult to browse as the content domain uses complex terms which are not easily recognised by the transcription software. MIT have approached the problem by developing specifically for lectures: a browser which includes video, audio and accompanying text and copes with the complex vocabularies beyond those recognised by a typical transcription dictionary.

In lecture theatres it has been noted that whiteboards are higher maintenance than originally hoped. Although they are clean and smart, they are difficult to read at distance and the lack of contrast is noticeable when making a video recording of information on the board. It is very common for the wrong type of pen to be applied and therefore the background, and contrast, degrades quickly. Chalk, however, is easier to use, less expensive, easier to clean and produces clearer text for video - the background even enhances the image of the speaker. The chalk dust generated is not really a problem if the environment is properly maintained.

To convert speech to text the first step is to capture the speaker clearly. A quality microphone is necessary to capture audio at a bandwidth suitable for automatic speech recognition - if sufficient processing power can be brought to bear. This process would appear to be a large scale pattern recognition problem (which typically consumes lots of processing power on expensive computers) but, as demonstrated by the popular SETI project that searches for patterns in scans for extra-terrestial intelligence, a distributed and comparatively inexpensive alternative is available. Spare processing power in a cluster of PCs, using Beowulf or Condor networks, can be used to tackle the problem by 'chunking' the audio into 10 second clips for analysis, distributing the task, then combining the results. Errors inevitably occur and these can be reduced if a series of lectures are used to 'train' the recognition, but humans can finish the job better with a few 'web 2.0' habits.

The easier elements of the audio provide the first 80% of the transcription but the last 20% can require significant deeper analysis which consumes too much processing time. However, event participants can be employed to do this far more efficiently and effectively; by combining Wiki features into the browser to enable an authenticated user to edit the transcription and quickly correct difficult words. The 'roll-back' features of the Wiki type interface can provide some security for the lecturer and browser service.

The lecture browser is available as a web tool from the MIT CSAIL (Computer Science and Artificial Intelligence Laboratory) at http://web.sls.csail.mit.edu/lectures/

Establishing identity beyond reality – representation in the virtual world through SecondLife®

The boundaries of the learning and teaching environment have been extending towards virtual reality ever since Virtual Reality Modelling Language (VRML) in the mid 90's. MIT recognised the potential within the virtual world long ago (Netspace project) but the rise and opportunities offered by of the 'Second Life' platform could not be ignored. MIT quickly recognises when "the genie is out of the bottle" and therefore seeks to harness it to its advantage. However, this can be difficult to control given that the SecondLife environment belongs to a commercial enterprise.

A lecture presentation in Second Life delivered from a virtual space created by the New Media Consortium.

The New Media Consortium (NMC), a community of learning-focussed organizations exploring new media and its technologies, provides spaces and virtual 'islands' in Second Life for low or no cost for academic use (http://www.nmc.org/pr/nmc-virtual-worlds). It readily helps educational institutions get established in new technologies and helps to reduce the risk to these projects; by using the NMC as a third party to host the MIT 'island' the legal risks for MIT are minimised. While virtual world projects exist for other purposes (e.g. Darkstar, Wonderland) technical standards are appearing which will enable migration between them – enabling resources to be shared. Integrating learning and teaching into these environments will take time but it appears that the persistent constructions in these spaces are the "serious ones". *Nature* publishing have recently established an island to host virtual events on key topics and issues.

MIT adopt an approach to the implementation of e-Learning similar to that used by many UK Universities albeit on a grander scale. They are extremely well resourced for a relatively small enrollement and can attract key players to key world-wide C&IT projects.

Additional information
Open Wetware - openwetware.org
iLabs - icampus.mit.edu/labs
MIT lecture Browser - http://web.sls.csail.mit.edu/lectures/
New Media Consortium - http://www.nmc.org/

Conclusions

The intention of the study was to discover the hidden issues behind the development of the e-Learning 'products' we encounter at the Subject Centre for Bioscience, so that we, as a Centre, might better understand the bioscience specific issues for e-learning development and help share what works well. In the four UK universities sampled, each had their own methods for producing e-Learning resources which were contextualised for their local needs, and in the case of MIT, some global ones. It is clear that strategies have evolved and it has been very valuable for the Centre to have this background information.

What has the Centre for Bioscience learned?
In our e-Learning survey of Bioscience academics in 2006, the biggest barrier to creating e-Learning materials was **TIME**. Often, our discussions with practitioners revolved around the the time taken to create these resources which could last for at least three years without the need for significant re-development. It was important to discover how this issue was addressed behind the scenes. Following the early crop of materials created and shared through previous networks (TLTP Bionet consortium, the CTI initiative and the LTSN) the community at large appears to have evolved strategies which have a productive outcome, but perhaps not an efficient one.

One of the notable developments in HE has been the adoption of the Virtual Learning Environments (VLEs) to co-ordinate delivery of teaching materials and provide wider access to the campus content. While we at Leeds had the benefit of being an early adopter of these (the Bodington VLE was developed here) we cannot allow our perceptions of VLE usage to be dominated by one platform. The UK case studies illustrated how different instutitions approached the preparation of materials for the VLE and the importance of the academic being aligned with the organisational policies, even to the extent of helping design them for e-Learning projects. Notably, Leeds Met and its WebCT 'leverages' the departmental network through supporting the academic *in situ* to assist with colleagues continuous incremental improvements by providing a friendly face.

It is clear that commercial forces have significantly influenced the paths for future development. The successful commercial organisations involve the academic practitioners in the development of the product using support forums, but will inevitably be biased to commercial considerations. It appears that open-source 'academically driven' solutions may be perceived 'not as-competitive' by some institutions due to the apparent lack of service infrastructure behind them, but Open Source projects are becoming established and will continue to be important in advocating and adopting standards for content exchange (Pan and Bonk, 2007). Institutions may prefer to seek to exert contractual pressure on the commercial provider to steer modifications. However, this may only succeed in providing robust common baseline functionality. We now see a rise in 'free' additional 3rd-party services, particularly in the use of blogs and wikis, and there appears to be a rising trend for 'loosely-coupled teaching' with these different tools being used to support activities within a module. Academics will always explore new paths so perhaps it is naïve to expect them to remain within the boundary of their VLE. Linking to external services and resources is becoming more trustworthy as their robustness is accepted by academia, which has been notorious for 'not-invented-here' syndrome i.e. not confident in solutions which have not been developed within the organisation. Academics are likely to go beyond the support training their VLE provider provides (Weller, 2007, JISC Infonet 2008).

The Leeds Met approach maximises the platform resource by training real practitioners to be readily available experts, building on the WebCT strategy for 'training the trainer'. If academics focus on securing the best pedagogical advantage out of the VLE and sharing these experiences literally 'down their corridor', then improvements can be rapid. Ownership of the process and development remains with the academics who soon establish confidence in the technologies and therefore align themselves with student expectations. Similarly, the incremental growth of e-Learning materials from small projects in Biosciences at Sheffield has built into a much larger and comprehensively supported suite. This is already aligned with the institutional practices for quality controlled and managed development since the Bioscience project itself helped define these institutional policies. Institutions learn from 'what goes wrong' internally but rarely (The CAMEL project for Collaborative Approaches to the Management of E-Learning being an exception) share these problems externally. The incremental approach to e-Learning development ensures that the product is always close to the demands and needs of the teaching – minimising the gaps that a 'step-change' requires.

This is not to say that there is no longer a role for the 'maverick' academic, who spots an opportunity to try a new idea and learn new skills. Technology is now very cheap and comprehensive web servers, with sophisticated applications, can be created with open-source software very quickly. However, these bespoke solutions often have support costs which grow more difficult to justify. It therefore seems very sensible to adopt an in-house development strategy which creates a vibrant community of developers who can mix-and-match commercial and bespoke software. The approach at Aberdeen to resource faculty projects with experienced application developers, who can re-use their advanced skills around the institution on similar projects, can combine the best of both: The academic gets a fully featured solution which looks and feels as professional as the applications that incoming students

are already used to: schools have been very well serviced with software based on the national curriculum – one of the benefits of commercial input into a uniform market. This approach helps the host institution also retain *and* develop its skills base; it is vital for it to be reliably informed by developers who are at the frontiers of e-Learning so the institution is not locked-in to external providers. This may be the most pedagogically robust and cost-effective formula. However, if a faculty is large enough, then developing a local talent pool working *with* academics not *for* them, could be considered as part of its C&IT and learning and teaching strategies.

Planning a major change in how formative assessment is embedded in the curriculum often needs significant funding to aggregate effort within an institution. The Essex SPRiNTA project's initiative that identified an opportunity to bring together a number of technologies for targeted formative assessment needed TLTP (Teaching and Learning Technology Programme) funding to bring the various parties together. Sheffield's approach of incremental development around a backbone of technology enhanced learning allowed web based delivery to be a natural extension of current practice. This is not to say incremental development requires less effort. Key here are the skills developed by the experienced tutors to apply the advances in technology, and how the students were engaged in the process through the design stages - their views were not just 'bolted-on' at the end of the project during the final evaluation. This again saved valuable time making sure the final product met the needs of the student.

The utilisation of 3rd party content is a significant time-saver but it has to be *exactly* what is required and must be readily integrated (Sheffield) and current (Leeds Met) to be valued. The Sprinta project (Essex), as one might expect, could not find suitable MCQ content for online assessment and had to create its own. This questionbank resource of around 600 questions has since been released to the community but these questions are difficult to adopt elsewhere as each institution builds its own curriculum. Only minor subsets may be re-useable (our Subject Centre is exploring these for mobile phone based formative assessment).

Sharing expenses

We have arrived at a paradoxical situation where an academic producing e-Learning material complains of insufficient time to create these materials, and would benefit from being able to re-use components produced during other e-Learning projects, but apparently they do not have time themselves to upload and share components of their own work: depositing learning objects (LOs) in repositories for others to share is too time-expensive given the lack of academic recognition of the effort of producing high-quality shareable content for use in Higher Education.

Re-use is a recognised problem with HE learning materials; for each to be re-usable in new contexts it often has to be broken apart into learning objects and fully described with not only a meaningful universal description, but also with data and meta-data to catalogue it efficiently – this is probably the hurdle that busy academics will refuse to jump without the help of a cataloguer. Also, the more advanced the material, the less likely it is deemed shareable as it becomes specialised for the local curriculum. If an academic was employed as a learning technologist (LT) however, then it would be clearly in their personal interest to use the repository as a host for a portfolio of their work and catalogue the LOs for re-use. Perhaps this is the model that needs to be developed. There are many sources of re-usable components in theory but apparently less so in practice. The UK Intute web service offers a comprehensive directory of online academic materials (compiled by its own cataloguers, not the broader academic community) but these are often websites that provide specific content or collections which are often only partly useful. The Re-Usable Learning Objects CETL provide ready made materials but JISC's JORUM repository seeks to provide learning objects which can, if required, be re-assembled in a bespoke fashion by the tutor. However, this process of adding descriptive data and meta-data is proving laborious for potential JORUM contributors. It appears to require a major effort to process any existing e-learning stock for JORUM and develop the 'granularity' (i.e. break down and describe the materials into smaller components for independent re-use) of available materials. There appears to be no real demand to do this although it is technologically attractive and was often suggested as an expected efficiency gain.

Future developments of the JORUM repository of learning objects are planned to lower the submission barriers further but the lack of incentives for the potential content producers must be addressed as the reward and recognition for them appears to missing - there are no RAE (or equivalent) metrics. Simple objects with quality descriptions (e.g. the Bioscience Imagebank) are popular probably because they are less dependent on the busy academic for the action of making the object shareable as this is done mostly on their behalf. The strategy used in Aberdeen to produce e-learning materials removes the burden of sharing from the faculty academic to the developer who, by nature, code their solution components for re-use.

The scale of projects addressed by MIT is beyond the needs of its own students. The problems are often internet-wide and it has opportunities to work with the development of the necessary standards which are part or the new solutions, for example in the partnerships formed in the science commons projects. MIT's engagement in the biosciences is significant so it has substantial projects to build upon. It knows when to acknowledge the role of the service industries in taking its products forward. Alliance with key organisations like Microsoft for the funding of its iCampus Projects and the involvement of ex-Sun developers for the OpenWetWare are collaborations which fortunately happen to be within the same campus as key World Wide Web Consortium (W3C) projects. However, projects have not been without problems extending these to the wider Higher Education community (Ehrmann *et al* 2006).

During my brief visit I noticed that the culture at MIT has an interest of mobile phone-based technologies for project collaborations, and a natural tendency for 'loose-coupling' of any technology which suits its purpose and resilient to frequent changes. Mobile micro-blogging applications like Twitter were more popular than in the UK as US messaging charges are lower, and the text-biased Blackberry device is more established. We now see evidence in our Bioscience community that this is growing, particularly because it has a steady trickle of fresh content, updates similar interests, very easy to use and is supported by both desktop and mobile tools.

Sharing experiences

The training of staff on how best to best deploy e-Learning materials and techniques varied between each institution visited. Each context is similar but different enough to require in-house staff development for delivery (even MIT provide in-house support to convert materials on behalf of its academics). Within an institution the staff have similar people in similar roles so a community soon forms that support a common infrastructure and purpose. However, e-learning assistance based on the disciplines themselves *between* institutions is more difficult. Academics converse over the academic and pedagogic issues around the e-Learning, not the technologies, and these discussions have to be networked through wider communities e.g. Higher Education Academy Subject Centre events, L&T conferences, and technically through Association for Learning Technology (ALT) events and JISC projects or organisations e.g. CETIS, NetSkills etc. The Centre for Bioscience has recently started a social network site (heabio.ning.com) to explore the potential for community driven networking of similar teaching interests and issues.

An institution may align its online delivery through the purchase of a VLE and this may produce a 'walled garden' which is comprehensive internally, but tends to reduce sharing opportunities across the disciplines between institutions unless the VLE platforms come from the same supplier. Non-commercial Open-source VLEs may offer better support for educational technical standards but the academic, busy at the 'coal face', rarely has time to pay attention to these. It appears that academic publication of pedagogical research and e-learning through journals and conference proceedings is the still the best outlet for recognition and we offer our Bioscience Education online journal for this purpose.

The rapid rise of social software over the last two years has modified student behaviour – self-support networks via the ubiquitous Facebook are peer led. Few academics would be keen to immerse themselves within these environments but they may find themselves mentioned there. Stories of defamatory remarks about teaching appear occasionally in the press but unfortunately comments about good quality teaching in these social network sites go largely unrecognised by the media. It is by no means unknown for students to set up 'fan-sites' for favourite lecturers and topics. In contrast to social network sites, academics are beginning to use web-logs to 'blog' details of teaching developments (and opinion) to raise both their subject's profile; for example they may describe how they have implemented IT to good effect in their teaching. The value of academic effort in blogs needs to be recognised and supported to help establish communities of practice nationally - skills to search and share blog postings are steadily growing and this is likely to be the quickest mechanism to discover new and interesting practices (Email is not the most efficient solution when the majority of those on a list tend to be listeners). We hope to pick up more about academic projects through blogs and social bookmark tags in addition to traditional routes as community skills are updated. It is in the interest of academics to control their representation on the internet and a personal blog is an ideal tool to do so. We must be very wary of the dilution of information through so many information exchange networks and it would appear that personal ownership with suitable tagging will be the best technical mechanism for gathering contributions as it reduces the need to have accounts on many environments.

Moving forward

Following publication of this report we will:

- Continue to network the knowledge and experience of practitioners of e-Learning to improve skills in the Bioscience community through our publications and events and, in addition explore new avenues to connect their activities through 'Web 2.0' technologies.
- Encourage recognition of practitioner's work through our events, reports, and publications to improve the reward for their considerable effort illustrating the value of ICT and how it can be adopted and adapted for use specifically in Bioscience contexts.
- Assist in the sharing and re-use of materials by either hosting them or helping to lodge them in appropriate repositories of learning objects.
- Represent the interests of the bioscience community in the JORUM repository project to help develop a useful national corpus of open educational materials.
- Continue to work with Intute to develop a combined Subject Centre and Intute catalogue of learning and teaching resources, including reviews of the value of its materials.
- Stay informed through the key services, email lists, newsfeeds, online communities and conferences and map their activities to our discipline community interests where possible.

The Centre for Bioscience is ideally placed to do this and we look forward to the continued support of our discipline communities. Registration for our e-Learning reference group is open here at http://www.bioscience.heacademy.ac.uk/network/elrefgrp.aspx and we look forward to adding your activity blog, attending our events or joining you to our social network site.

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Additional information

A few recommended sources for further information are listed below:

Sharing resources

JORUM - a free online repository service for teaching and support staff in UK Further and Higher Education.
www.jorum.ac.uk

Re-usable Learning Objects Centre for Excellence in Teaching and Learning
www.rlo-cetl.ac.uk/

CAMEL project
Collaborative approaches to the management of e-learning
www.jiscinfonet.ac.uk/camel

Social bookmarking with delicious
http://delicious.com/

Sharing standards

Science Commons - www.sciencecommons.org

Building open content - video discussion from the Oxford Internet Institute discussing Creative Commons licences and specifically science issues)
http://webcast.oii.ox.ac.uk/?view=Webcast&ID=20070208_179

JISC Cetis Centre for Educational Technology and Interoperability Standards
http://jisc.cetis.ac.uk/

Image sharing

Centre for Bioscience Imagebank
www.bioscience.heacademy.ac.uk/imagebank

Flickr - www.flickr.com

Video sharing

Youtube uk - http://uk.youtube.com/

Google video - http://video.google.co.uk/

Blip.tv - www.blip.tv

Emerging Technologies watch

JISC Techwatch (Technology and Standards Watch)
www.jisc.ac.uk/whatwedo/services/services_techwatch/techwatch.aspx

Educause Horizon report 2008 (identifying the emerging technologies likely to have a major impact on Learning and Teaching)
http://connect.educause.edu/Library/ELI/2008HorizonReport/45926

Blogs

Centre for Bioscience e-learning reference group subscription page (includes links to bioscience blogs)
www.bioscience.heacademy.ac.uk/network/elrefgrp.aspx

Twitter microblogging

www.twitter.com

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http://publications.csail.mit.edu/abstracts/abstracts06/hazen2/hazen2.html
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Pan, G., & Bonk, C. (2007) The Emergence of Open-Source Software in North America. *The International Review of Research in Open and Distance Learning* [Online] 8:3.
www.irrodl.org/index.php/irrodl/article/view/496/938 (accessed April 2008)

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http://nogoodreason.typepad.co.uk/no_good_reason/2007/11/the-vlelms-is-d.html
(accessed April 2008)

Contacts

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www.leedsmet.ac.uk/teaching/tfn/index_C72F28B6E60146FC8F3DC023A298EB13.htm

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web.mit.edu/longpd/www/longpd.htm

Phil Marston
www.abdn.ac.uk/clt/

Martin Sellens
https://www.essex.ac.uk/bs/staff/sellens/index.shtm

Alistair Warren
http://www.shef.ac.uk/bms/research/warren

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The square dot pattern is an example of a QR-code which acts like a barcode for mobile phones to visit a website just by taking the photo.