Supporting staff using WebCT at the University of Birmingham in the UK

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Abstract: At the University of Birmingham, Information Services, together with the Staff Development Unit and the Learning Development Unit have been working together to set up a number of initiatives to support staff to use WebCT to underpin its learning and teaching strategy within a flexible framework. The framework seeks to invest in developing appropriate skills and training for University staff to ensure that the quality of the content and the communication tools within the WebCT environment are fully exploited to enhance the student learning experience. Developments include the establishment of an e-Learning module, team based projects from the Learning Development Unit and a WebCT training and support pathway.

Keywords: WebCT, Academic and support staff training, e-Learning in higher education; University of Birmingham

1. Introduction

The JISC Managed Learning Environments Information Pack (1) suggests that

> *"the implementation of a VLE [Virtual Learning Environment] without significant investment in developing staff will almost certainly not produce good results".*

At the University of Birmingham these sentiments formed the basis upon which a Virtual Learning environment was implemented. The University had adopted WebCT as a tool underpinning the learning and teaching strategy and to support developments in e-Learning. Staff within Information Services, Staff Development Unit and the Learning Development Unit have been working together to invest in developing appropriate skills and training for University staff to ensure that the quality of the content and the communication tools within the WebCT environment were fully exploited to enhance the student learning experience. In order to move to this position a number of developments took place to ensure the benefits of e-Learning were fully realised. These developments included the establishment of an e-Learning module, team-based projects from the Learning Development Unit and a WebCT training and support pathway.

2. A University in the 21st century

The University of Birmingham was established by Royal Charter in 1900. It has approximately 24,000 registered students, which comprise undergraduates (c16,500), taught post graduates (c4500) and research postgraduates (c2500). The University undertakes teaching and research in 34 of the 42 subject disciplines as currently defined by the Quality Assurance Agency. The university is a research led institution with a national and international reputation reflected in its membership of organisations such as the Russell Group and Universitas 21. As a well-established campus based University, Birmingham has also developed standards of provision and quality of a learning environment well suited to the changing demands of students, whether these students are undertaking learning on a part time basis or from a variety of locations. As part of the University developing and adapting its provision in the light of the changing environment within Higher Education, consideration has been given to developing teaching and learning within flexible frameworks. The flexibility seeks to maintain and enhance the established strength of this civic University in order to respond to the challenges and opportunities represented by increasing student numbers, national plans for the expansion of Higher Education and the Life Long Learning Agenda. Entry of students into Higher Education via non-traditional routes, with different skills and prior qualifications underpins the benefits afforded by the technologies within the managed learning environment and the possibilities in learning and teaching.

Support for this development and integration of a more learner-centred approach to student learning is provided by Information Services at the University of Birmingham. Information Services is an amalgamation of library, computing and multimedia services to form a coherent whole to support the learning, teaching and research carried out at the University. Information Services is managed

through a number of Divisions including a Learning and Research Support Division which has a remit, amongst other things, to support developments and the changing basis of learning and teaching - such as e-Learning and WebCT. The Learning and Research Support Division also houses the Learning Development Unit which was at the forefront of pushing the e-Learning agenda.

After lengthy discussion across the University, it was agreed that the WebCT package would provide the necessary functionality and ease of use of a VLE for staff and students at the University. After several tests of the main products it was agreed that the University of Birmingham would provide support for, and standardise on WebCT. At the time of writing Version 3.6.3.8 is supported. WebCT was also the largest known product at the time and there were no CHEST deals (Higher Educational Community software) for any VLE. Subsequently, the package was specifically identified within the learning and teaching strategy of the University.

2.1 The Learning Development Unit (LDU)

The Learning Development Unit (LDU)(2), which was set up in September 2000 supports the University's Learning and Teaching Strategy. It aims to enhance the quality of learning and teaching using a number of approaches including:

- Working with the Staff Development Unit [SDU] to provide training in flexible learning methods for academic and support staff.
- Working with the SDU, the Academic office, Information Services and other interested parties to ensure that infrastructures are developed to support flexible ways of learning and teaching
- Ensuring collaboration, development and dissemination of effective practice in learning and teaching innovation.

The Staff Development Unit ensures that staff are able to acquire the skills, knowledge and expertise to carry out their duties. In order to achieve this, the LDU fund and support a number of team based projects to develop best practice in developing, implementing and supporting learning and teaching. A number of these projects involve developments in e-Learning and are discussed below.

3. Learning Development Projects

The HEFCE Teaching Quality Enhancement Fund funds the LDU and the projects it supports. The LDU aims 'to encourage pedagogic developments by funding projects that integrate flexible ways of learning and teaching into the mainstream curriculum'. The University originally envisaged that members of academic staff would be seconded to projects for up to half their time. However, in practice a team-based approach has been adopted. This involves a number of people who have been seconded for smaller amounts of time, to a total of up to maximum 0.5 of an FTE. Bob Hunter, the Director of the LDU, encourages this team-based approach and most projects involve a mixture of School and Information Services staff, right from the initial bidding stage.

Applications for funding are reviewed by the LDU Advisory Board. The criteria for funding include

- Approval by the Head of School and the Director of Learning and Teaching within the School, including a commitment to use some of the funding to provide cover for staff who are seconded to the project
- Evidence that the project will support the University's and the School's Learning and Teaching Strategies
- Evidence that staff development needs have been identified
- Strategies for evaluating the project and disseminating the lessons from the project
- An indication of how the innovation will become embedded within the work of the School
- Evidence that the lessons learnt from the project will be transferable to other Schools

The LDU also provides bookable office space for Project Leaders and members of project teams. This enables staff to get away from their own offices to a place where they can concentrate on project work with relatively few interruptions. It is also a place where people working on related projects can get together to share ideas and good practice. The PCs are equipped with a wide range of software, including the standard suite of MS Office software and a range of applications for producing web based learning materials. Such support ensures that staff at the University can be assisted in the management, development, implementation and, perhaps more importantly, appropriate evaluation of their projects.

3.1 Examples of LDU Projects

Since its inception in 2000 the Learning Development Unit has supported and developed in partnership with academic staff a number of projects to encourage pedagogic developments in the use of WebCT. Although these projects differ in terms of the Schools they emanate from, a number of common themes across the projects have emerged. By considering some key examples of projects supported it is hoped to provide a flavour for how WebCT is enhancing the learning experience of students at the University of Birmingham, as well as to produce more pointers for ensuring that the features of the managed learning environment employed (ie WebCT) are being fully exploited. Use was being made of WebCT to overcome some of the current challenges afforded Higher Education (identified in the introduction to this paper). It was also becoming clear as these projects began to be evaluated that staff felt that they did not always have the requisite skills to fully exploit the VLE tool or to develop their students within the online course. It was also felt that the project leaders for these LDU projects would become WebCT champions to raise the profile of the VL and to ensure that is it used effectively and widely. The projects could then become examples of good practice and encourage others to explore the different options.

3.2 Enhancing the Learning Experience of Off Campus Students

- On-line learning support for students on fieldwork placements

This project sought support for students on a Community, Play and Youth course. The main aim was to ensure that students were able to gain valuable experience from the placement element of their course. In particular, that students would not feel isolated when on placement as they would be able to use WebCT to facilitate better communication between students and their tutors and amongst the students themselves. WebCT was also used to administer the placements and deliver information to students about assessment requirements. The Project leader noted that "there has always been a danger that placement was regarded as "real life" and university as "academic life". For the LDU project it was decided to see if the introduction of "virtual life" could help bridge the two worlds. In evaluating the success of the project a key lesson came to the fore. That is, should one introduce new WebCT courses with new students? First year students were happy to make use of the online support environment, as they knew no different. However, it was found that students who had experienced different forms of support (telephone calls from tutors, appointments with tutors) that there was "unanticipated active resistance" from the existing students. Further, the project leader felt that she was not all together clear how she had expected the students to make use of the communication facility. The suggestion was that the tutor needed more experience of managing the communication tool.

3.3 Developing learning communities

- Public Sector MBA

The use of the communication tools such as discussion boards and email has resulted, according to the feedback from students, in providing more confidence to these students to take part in face to face learning such as tutorials. Students also report a sense of "Class Culture" being developed online. By ensuring that the course content section was utilised fully students were provided with the opportunity for reflection on seminar material. Non-native English speakers, who were able to prepare more confidently for face-to-face seminars and use WebCT as a revision tool, especially welcomed this. The project leader, on reflection, suggested that there was more opportunity for developing collaboration with other tutors for integrating online resources of use to the students as part of their course and for revision purposes.

3.4 Development of Generic Skills

Students arriving at the University bring with them a wide variety of Information and Communication Technology skills making it quite difficult to deliver a suitable "one size fits all" ICT training. This is made even more difficult if the traditional delivery methods are used as there are basically too many students and not enough resources. As a result, a blended approach to ensuring that students have access to a variety of learning materials which support the development of their generic skills. The project is based on the Impetus training materials for Microsoft office applications, combined with locally produced materials, all of which are to be delivered using WebCT. Students can then make use of the available resources as they see fit, dependent upon their individual needs. Although this is not intended to replace face to face training for students who are complete beginners it is intended to help bring all students up to an acceptable level of ICT skills in order that they may complete the rest of their degree

programme adequately. The main difficulty for this project has been the lack of experience of the programme tutors in adding appropriate content and writing materials in a style required for this sort of environment.

3.5 Using ICT for Assessment

- Computer-based student centred learning and assessment resources – Highway Management & Engineering
- Physiotherapy

These projects looked to the WebCT environment to develop the assessment aspect for their modules. The courses sought to integrate a link between the written assignments or quizzes and the documentation or other media within WebCT. For example, the Physiotherapists use video clips on CDROM about how to examine for a particular scenario and this is then linked back into the WebCT environment for the students to answer specific questions which are then assessed. This is a useful blended approach using a mix of media to enhance the learning and teaching experience of the students. However, the project leaders felt that there was more scope for developing the assessment approach being supported in this environment which was not being fully exploited in this project.

It was becoming apparent, therefore, that more knowledge was required about the principles of E-Learning if staff across the university campus were to be fully supported in exploiting this developing environment. Further, if Information Services were to meet the challenge of supporting the University wide agenda of promoting a managed learning environment effectively then effort was required to set out a flexible framework of staff support. The difficulty facing the Learning Development Unit and Information Services was the range of staff with different needs. Some wanted help on writing materials for this environment whilst others on using new software.

The main area of concern for support staff centred on developing the principles and techniques of e-Learning pedagogy for staff to bring to bear on their projects and a deeper understanding that underpins current practice in online learning and teaching. Despite the fact that this was a fast developing area there appeared to be no course available (externally or internally), which met the needs of the staff at the University of Birmingham. Therefore an approach was made to two external consultants to work with the Staff Development Unit, the Learning Development Unit and Information Services to develop a module on e-Learning in Higher Education which would go some way to addressing the concerns rising out of the evaluation of some LDU projects.

The two external consultants had experience in promoting the use of flexible learning, had developed frameworks for accrediting key transferable skills and had been involved with e-Learning projects. The result was the creation of a module on e-Learning in Higher Education that sought to provide staff at the University with the knowledge and the theoretical content to undertake all aspects of online learning and teaching in Higher Education.

4. The learning outcomes of the e-Learning in Higher Education module

The course, created for the University of Birmingham, set out to develop knowledge and skills in e-Learning in Higher Education with the following specific learning outcomes:

- demonstrate knowledge of the underpinning theoretical content that currently informs online learning and teaching in Higher Education;
- critically evaluate online learning and teaching tools and resources within a managed learning environment;
- demonstrate good practice in supporting online learning and teaching;
- demonstrate good practice in developing online learning materials and programs including the use of online assessment tools;
- apply the processes of critical evaluation and reflection to your work.

It was aimed at anyone who had an interest in the delivery and support of e-Learning. At the University this meant that the participants were drawn from academic staff in a wide range of disciplines (Law, Political Science, Education); Information Services staff (Liaison Librarians responsible for liaison within Schools, Lab Managers and IT advisors) and Learning Development Unit staff.

This range of staff led to a very productive exchange of ideas and perspectives and helped reinforce the team approach to supporting E-Learning on campus.

The learning and teaching methods employed include:

- tutor led and student led online discussions and conferences;
- use of case studies and real life scenarios;
- project work involving working in one collaborative, one problem solving and two co-operative learning sets to produce specific reports or products (e.g: web-based learning resources or online assessment tools;
- Online seminars involving guest speakers;
- Open learning materials;
- Self, peer and tutor evaluation and feedback;
- Development of reflective practice using learning journals.

The structure of the course revolves around online participation by the participants within the managed learning environment (WebCT) based on four workshops. These workshops cover

- introduction to online learning and teaching;
- online tutoring;
- design of online learning programmes and resources;
- online assessment and evaluation of student learning.

On completion of the course participants obtain 20 academic credit points at M level towards the Postgraduate Certificate in Learning and Teaching in Higher Education and eligibility for the Associate membership of the Institute for Learning and Teaching.

Overall, the module covered the underpinning knowledge necessary for participants to undertake all aspects of online learning and teaching in Higher Education. This included coverage of underpinning theoretical content that currently informs online learning and teaching in Higher Education. Participants were able to develop their knowledge and skills in developing and using teaching tools and resources in a managed learning environment; online tutoring; design and development of online learning materials or programmes; assessment of online learning; The participants were encouraged to engage in and experience a number of different approaches to online learning, i.e collaborative problem solving and co-operative learning sets. Participants were encouraged to critically evaluate and reflect on the online work carried out.

Participants were expected to be online up to two hours per week but on reflection this was an underestimation of the need. There were a number of online activities - both individual and group centred work - which employed different learning styles from collaborative to co-operative. These online activities, often called e-tivities - helped to mobilise, engage and enable the participants to progress through the learning experience. The course also had guest speakers (experts in their field of study but drawn from a variety of locations - academics in Australia to researchers in Manchester) who contributed and added their valuable experience to the online discussions.

4.1 Support for participants

A key feature of the course, particularly given its online nature, is the role given to mentors to the participants. The mentor's role is really one of a confidential sounding board and critical friend. That is someone who can provide support and advice and help participants to adapt and adopt their ideas. The mentors were drawn from across the University and externally as well.

4.2 Assessment of the module

Assessment of the module has been on going since the start of the course and is based on a Portfolio of work.

4.3 Learning Journals

One aspect of assessment has been the use of learning journals to help chart progress, problems, challenges, thinking and development over the period of the course. The Learning Journal helps individual learners record developments and to reflect on the links between theory and practice. This journal has been kept since day one. It also forms part of the Portfolio of e-Learning Practice, which provides evidence of the satisfactory attainment of the Institute for Learning and Teaching learning outcomes and of adherence to the ILTs professional values, and thus fulfils the requirements for Associate membership of the ILT.

4.4 The Portfolio

The portfolio consists of examples of learning design and planning; learning support and the establishment of effective learning environments covering the defined learning outcomes of the module. The evidence in the portfolio demonstrates how the learning outcomes have been achieved through the process of critical evaluation and reflection. The examples in the portfolio are both descriptive and explanatory showing why certain pedagogical decisions were made and hence understood within the overall learning

context of e-Learning. The portfolio also shows how professional values have been integrated into the work as a supporter of learning. In particular it includes 30 hours in supporting learners online including 2 peer observations, 2 observations from the mentors and 2 tutor observations drawing upon the learning journal.

The pilot course started in November 2001 and has provided the participants with a better understanding of the theory and practice of e-Learning. This means that staff are more informed when extolling the theory and practice of e-Learning across campus offering practical suggestions and comments from real life experience. For example, having an appreciation for how group discussions may facilitate learning not just how to post a message within the environment!

At the time of writing, the pilot module is nearing completion. Feedback from participants and tutors has included two significant concerns about the course. Firstly, that there is too much material in the course and secondly that there was not enough time to devote to such a course. Despite the fact that material was taken out of the later units of the module in response to this problem, some participants still struggled to fit the coursework in around their work and other commitments. Some of the participants on the course also found that the latter half of the module, which concerns course design and content development, is not as relevant to their day to day work as the first half of the course. This is because many of the participants supported e-tutors and students on courses, which were created by someone else, and so have little control over the actual content.

5. E-Learning in Higher Education II

The next reiteration of the module has been modified to reflect this feedback. The next session will run as two 10-credit modules with the opportunity to apply for Associate Membership of the ILT on successful completion of the two modules. Each module will run for 10 weeks and assessment will be by portfolio.

- The first 10 credit module will focus on e-Tutoring and will be a pre-requisite to the second module;
- The second 10-credit module will focus on content design and delivery;
- The learning outcomes for both modules are very similar in nature to the overall E-Learning module with an emphasis on the application of critical evaluation and reflection to the online work.

Both modules are aimed at different groups of staff that share a common interest in e-Learning: information services staff; academic staff; and school staff involved in the development of LDU and similar projects. Both modules run on-line and each are supported by two face-to-face workshops.

It is intended to run the first E-Tutoring Module from October 2002 to December 2002 with the E-Content Design & Development Module running from January 2003 to March 2003.

6. But what's it really like to be an E-Learner?

Staff at the University of Birmingham were, therefore, in a unique position to be developing their online skills whilst participating in an e-Learning environment. The participants were then able to come to understand and sympathise more fully with the student's potential online environment.

Formal evaluation of the course has not yet been completed, as the course only ended in November 2002. However, the Author carried out an email survey requesting responses to four questions only to help obtain some quantitative data for the purposes of this paper with the following results.

6.1 Overall experience

As with any course one enrols on the expectations and experiences of the participants are as far ranging as the participants! Therefore all participants were able to draw upon their learning journal in order to answer these simple yet informative questions about the participants experience of the module.

All the participants felt that they had benefited from taking part in the module and that the support they now provide for student learning and teaching is enhanced. The course itself entailed daily visits to WebCT with effort being expended on checking resources, contributing to the growing themed discussions and reviewing activities for the current workshop. Participants reflected the hybrid team approach (with participants pulled from areas reflecting the make up of the University) in comments such as:

"One of the most important learning outcomes for me has been a real/fuller

awareness of just how much so many specialists have to contribute in designing and delivering the e-Learning experience"

Throughout the course there was encouragement to pair up to facilitate sharing of ideas and expertise and to develop e-practice that is appropriate and satisfactory. The opportunity to make use of the WebCT environment, providing the participants with the direct experience of networked learning, was particularly welcomed. More specifically identifying how students might interact with electronic media from a practical and pedagogic perspective made the experience all the more real.

This exchange was probably the most useful aspect of the whole course and one that continues as the course comes to a formal end. The opportunity to work within a community of practice and engage in reflective practice of a new and developing area was welcomed by most participants.

Basically, it was realising that I was not alone in this job and that other people have the same problems and are benefiting from one another

For many the main difficulty with the course - was time. An example of this comes in the form of a response to the survey carried out which said

I find it extremely hard to manage my time and to get to grips with the demands of the Virtual Learning Environment

Several participants reported difficulties with actually using the VLE. Just because the environment is built around a web interface does not automatically translate to the participants being familiar with using the specific features of the environment in an interactive way. Age did not seem to be a significant factor here (some of the younger participants struggled more than the older ones) but more of a gender issue. Several individuals who struggled were female, but this may simply reflect the fact that more of the men on the course had prior experience of using WebCT than did the women. The introductory session to the environment over-estimated the skills levels of the participants and many left the introductory session feeling more frustrated than enthused about the product. It might have proved useful to provide a basic follow up activity for these participants to overcome their fears early on rather than being launched straight into the first key assignment. Perhaps the introduction of a buddy system might have worked to encourage those who felt they never caught up with the initial difficulties of the system.

As the course developed and many of the participants were able to create their online roles there were some participants who rarely (if ever) participated. Some of the participants felt that the tutors could have done more to encourage and cajole those participants who were struggling. Further, that there was more scope for an e-Tutoring role to manage and enhance the online discussions which take place. The discussions would have also benefited from additional useful resources being added. This has been reflected in the e-Learning module II.

The experience has also provided more confidence for some of the support staff to provide appropriate guidance and advice on using VLEs. When support staff such as subject librarians or lab managers discuss with tutors how they might implement WebCT staff are able to provide positive suggestions and a real insight into how the structure might be perceived by their students. For example, how one might provide a reading list with links to the actual catalogue record so that students can see where the item is (given that not everything is available online) or how to theme the discussions so that students can opt to contribute to specific areas and not have to scroll through hundreds of emails first.

6.2 Features participants liked about the module

Participants were asked about features of the course they particularly liked. These included such features as an opportunity to develop an online voice. This was especially true of some of the support staff; developing skills in reading and following threads online which helped to sharpen their critical evaluation skills; being able to develop as a self motivated manager of the learning process; exchange of experience, ideas and topics from multiple perspectives (from academic staff to IT advisors to librarians); and greater equality of all participants regardless of age, gender or race. This was especially welcomed by staff where English is not their first language.

6.3 Features participants did not like about the module

Participants were then asked about one thing they did not like about the course. The responses which appeared more than once included too many messages within the themed discussion lists - particularly felt by participants who did not log on regularly enough and then felt overwhelmed when they did; not enough time with which to carry out the e-tivities given a range of other commitments as well (not particularly unique to the online environment!); changes in time management; impersonal nature of online communities and not having necessary technical skills to understand or take part in some of the activities outlined.

6.4 WebCT Training and Support pathway

The benefit of introducing WebCT to support e-Learning brought with it challenges relating to implementing support in a constructive and flexible framework. A number of skills were identified if WebCT was to be implemented appropriately including technical advisors, instructional designers, knowledge managers, complex content providers and academic content experts. WebCT finds favour in motivating many students to use a familiar environment and to promote the tutorial or discussion aspect of the learning process. However, many tutors who are enthusiastic about the package comment that it can be time consuming to put any material into the environment or to make appropriate use of the communication tools. Although WebCT works within a familiar environment, putting content in and managing the communication tools is not always straightforward (indicated above from the e-Learning participants).

Therefore a useful supporting framework is necessary if a) staff at the University of Birmingham are going to make effective use of it and b) academics at Birmingham who are not habitual users of IT are to make use of it. At Birmingham a " WebCT Training and Support Pathway" has been developed to bring together the range of WebCT related training materials already available into a coherent structure. This pathway provides a web-based support site, training courses and other information deemed appropriate to support staff in exploiting the WebCT environment.

6.5 WebLearn Web Site

The WebLearn website is the focal point for training materials, frequently asked questions and details of how to apply for courses. Groups of students are then assigned to courses using information from the centrally managed student record system held at the University. The site can be found at www.weblearn.bham.ac.uk It was created by a project team made up of liaison librarians, IT and learning advisors.

6.6 Training Pathway

The Training Pathway has developed a modular course structure including a "Getting Started with WebCT" course. This course, based on a template structure, is intended to be a "short, sharp, introduction to the benefits of WebCT as a learning package. Staff bring along their own content to be uploaded into WebCT. By the end of the session staff then have the basics of a course which a) has their content within, b) they can develop by attending other sessions and c) their students can use straight away. The intention is that this "taster", delivered by Liaison Librarians, will hook staff into WebCT and that, as they are developing their own courses pressure will come from students to continue the development.

IT Trainers then deliver the additional applications content within this modular structure which includes constructing and managing course content; using communication tools; using assessment tools and student management. This structure is underpinned by drop in sessions for academic staff to discuss and apply techniques in their own WebCT environment. To ensure that all WebCT features are exploited demands a lot of staff time and commitment.

Documentation from the pathway is available from the Weblearn WebSite, which provides further help, advice and examples of courses already running with WebCT. Although there are no formal courses to train undergraduates the subject librarians are being asked more and more to include an element of WebCT introduction in the general induction to library services. There is basic instruction on setting browsers to enable JavaScript and setting the cache to always reload a page to ensure the latest version on the WebLearn website which can be cumbersome - particularly when the access is from student clusters.

7. Conclusion

The E-Learning module, Learning Development Unit projects and the training and support pathways ensures that the University

of Birmingham has provided the necessary investment in developing staff so that the implementation of a VLE produces good results.

The approach adopted at Birmingham enables the interactive nature of WebCT to enhance the student learning experience and provides a useful tool in this respect. It is anticipated that WebCT as a learning environment will be well received. However, WebCT is only the tool and its effectiveness will depend on the quality of the content including the learning resources and the use made of the communication tools. Universities, including the staff, have to change if they are to survive. All aspects of developing an online environment need to be carefully monitored and evaluated to ensure that the student learning experience and the change in current education practice is enhanced and that the University and its staff are sustainable in the 21st century.

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Evaluating Virtual Learning Environments: what are we measuring?

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Abstract: A basic framework is proposed to distinguish between the many ways in which Virtual Learning Environments (VLEs) can be evaluated. This includes the purpose of the evaluation, the type of methods that might be used and the measures employed. The framework is not intended to cover all applications but offers one means of structuring a review of past studies or may provide guidance on the type of study to conduct. A pilot study is introduced which compares an online course using different platforms which aims to measure engagement, participation and achievement of goals.

Keywords: purpose, methods, measures, usability, learning.

1. Introduction

Institutional strategies for the development and use of ICT in Higher Education in the UK are now in place, as recommended by the Dearing Report. At the University of Reading, one of the principles of the strategy is that new technologies should encourage rethinking of pedagogical aspects of teaching, learning and assessment. The Virtual Learning Environment Blackboard was purchased in August 2000 and there are currently approximately 100 courses online. The Universidade Federal de Pernambuco (UFPE) in Brazil, the home university of the co-author, has developed their own system, VirtusClass.

Evaluation provides feedback for course developers on teaching and learning and is an important part of quality assurance. However, constraints on time and possibly expertise preclude most developers from detailed studies. Whilst it is still important to carry out evaluations of individual courses, looking for more general principles derived from experiments can provide guidance in the design and development of VLEs. Such research may also address issues that are not covered in many evaluations.

1.1 Outline of paper

Having discovered the range of evaluation studies of VLEs and related learning technologies reported in recent relevant journals, this paper outlines a basic framework to distinguish between evaluations. The framework was developed to provide the context for discussion of a pilot study looking at the effects of group orientation on students' engagement, participation and task engagement. Dimensions are therefore identified that may be relevant to this study. However, the framework is intended to be of more general use. It may offer a means of structuring a review of past studies, for example, to identify the most relevant, or may provide guidance on the type of study to conduct.

The pilot study is introduced by defining the theoretical position underlying the research. The variables chosen for investigation are outlined and the pilot tests the appropriateness of these variables. Outcomes are briefly described with suggestions as to how the design of future studies can be informed by these results.

2. The nature of evaluations

In considering literature on the evaluation of VLEs or similar technologies, it is apparent that there are many different approaches to studies. A useful framework has been devised by Oliver (1997), which provides a comprehensive guide to the evaluation of the use of educational technology. This report is used as a starting point for discussion of the factors that are considered relevant to the current paper.

It is possible that the term 'evaluation' may be restrictive in the current context. Evaluation has been clearly explained by Oliver (2000) as 'the process by which people make value judgements' and when applied to learning technology, he suggests that this is often the educational value of innovations or practical issues in introducing new teaching methods and resources. Whilst the overall objectives of such evaluations are likely to be identifying what may improve learning, some evaluations have specific outcomes, whilst others aim for more general relevance. Oliver (1997) is well

aware of this distinction, which is built into the five purposes for evaluation (described below). A more marked distinction is made in the current paper by suggesting that it may be helpful to regard some studies as 'experiments' and some as 'evaluations'.

2.1 Purpose of evaluation

2.1.1 Roles

The starting point for distinguishing between different evaluations is naturally the purpose of the study. Oliver (1997), based on Draper, Brown, Henderson and McAteer (1996), identified five roles for evaluation: formative, summative, illuminative, integrative evaluations and quality assurance. Quality assurance is undoubtedly a specific purpose for evaluations. However, within the field of Human Computer Interaction (HCI) formative and summative evaluations are characterised by the stage in the development process at which they occur (Preece, Rogers, Sharp, Benyon, Holland and Carey, 1994), although this also defines their purpose. Explanations of illuminative and integrative evaluations illustrate the close relationship between purpose, approach (e.g. experimental versus ethnographic) and measures. For instance, illuminative evaluations are described as being primarily ethnographic, as opposed to experimental. Their purpose is to discover issues considered relevant by participants. Integrative evaluations are closely related to illuminative and aim to provide specific guidance on delivering effective teaching and learning.

2.1.2 Experiments

Four of these five roles are identifying problems, describing and interpreting events, rather than studies, which may test a single well-defined question (summative evaluations) and provide results of more general relevance. These objectives provide criteria for distinguishing between evaluations and experiments. A case study of web-based support for a campus-based course (Holt, Oliver and McAvinia, 2002) departed from the more usual focus on the particular system and cautiously discussed the wider implications of the study. A more obvious example of a study that would qualify as an experiment is Woods and Keeler (2001), which assessed the effect of adding audio to emails. The specific research questions were whether the audio messages would increase the frequency of student participation and length of utterances in online asynchronous group discussion and whether they would also result in more favourable student perceptions.

The classical design of an experiment is a comparison of conditions, sometimes with a control group. This was carried out by Woods and Keeler (2001) in the study referred to above. They compared three levels of audio messaging (weekly, monthly and every other month) with no audio messages (the control group). These designs can be problematic in natural settings due to difficulties in achieving comparable situations, avoiding contact between groups where they may share material specifically intended for one group, and possible ethical problems such as depriving some people of a potentially richer learning environment.

2.1.3 Usability versus learning

Another dimension that separates studies is the approach adopted by the specific discipline. Whilst studies within the educational field aim to assess students' learning outcomes, situating the evaluation within an educational context that incorporates assessment, an alternative objective is to measure usability of the system and its tools, drawing on HCI research. An example of this is Chang (2001) who investigated whether a web-based learning portfolio enhances learning outcomes by measuring the usability of the system.

Definitions of usability vary but there are similarities in the type of variables they tend to measure. These include effectiveness, efficiency and satisfaction (ISO 9241), ease of remembering and error rate (Nielsen, 1993). Commonalities among definitions found in the literature are making the use of a system easier and more comfortable for the users, whilst guaranteeing a high level of productivity.

However to measure the level of productivity in the field of learning technologies may be particularly difficult. The crucial point is the conception of learning that underlies evaluation. Typical measures used to evaluate the usability of a system, response time, accomplishment of tasks, error rate, etc. are suitable for a large range of systems and even for Computer Assisted Instruction Systems (CAIS) or Intelligent Tutor Systems (ITS). However, if learning is conceived as a matter of process, during which a transformation of knowledge occurs, such measures say nothing about how new knowledge has developed and what is necessary to support this development.

As all activity within a VLE is carried out through the interface, it is important to examine

how this may support learning. However, it is unhelpful to take the evaluation out of the learning context to focus only on ease of use of the system. The purpose of the evaluation should determine what is measured but it is the conception of the investigated phenomena that defines what is actually observed. In usability research the focus of the studies seems to be the individual using the system. Cultural factors that surround the use of the system are not included in the analysis. The context is merely a scenario that provides information about the task performed but is not part of the experience. Usability and learning may be combined in a single study, but each will have their own individual measures. How measurement is conducted is affected not only by the specific variables, but also by the circumstances surrounding the evaluation.

2.2 Methods

2.2.1 Interpreting results

Employing experimental methods to evaluate learning technologies is often considered inappropriate due to the difficulty of controlling variables that may affect outcomes (reviewed in Jones, Barnard, Calder, Scanlon and Thompson, 2000). However, in a natural context, where the technology may be only one part of a course, other evaluation methods will also lead to difficulties in attributing learning outcomes to use of the specific technology (Scanlon, Jones, Barnard, Thompson and Calder, 2000). Put forward as a negative feature of experiments, Gunn (1997) points out that the rigid nature of experimental design restricts the research. This limitation may however have its advantages when trying to interpret results. Despite differences between evaluations and experiments, similar measures may be used in both.

2.2.2 Process versus outcome

One approach to the classification of methods is to consider which aspect of the activity is evaluated. In relation to assessment, Heppell (2000) has argued for moving the focus from product to process. The way a student completes a task should be considered as important as the final product. This distinction is also made in studies that explore reading (Dillon, 1992; Schumacher and Waller, 1985). Process measures deal specifically with how readers use documents, and outcomes (or products) are reading rates and comprehension. Both process and outcome are appropriate to the evaluation of learning technologies and their use varies among studies.

2.2.3 Qualitative versus quantitative

Much is made of the 'paradigm debate' (Oliver, 2000), which concerns qualitative versus quantitative techniques. This debate will not be elaborated further as it has received sufficient attention by other authors. Fortunately not all authors of evaluation studies feel they need to take sides by adopting only one methodology (e.g. Woods and Keeler, 2001).

2.2.4 Subjective versus objective

A distinction in methods that is also relevant, but not given the same emphasis as the above debate, is the difference between subjective judgements and objective performance. Although the importance of measuring learners' perceptions of many aspects of VLEs should not be understated, such measurements cannot indicate, for example, ease of use nor ability to support learning. In an evaluation of VLEs and learners, Richardson (2001) explored whether individual differences of learners affect their perceptions of virtual learning environments. This is an extremely interesting research question. However, it would also be interesting to know whether individual differences affect learning performance.

In reflecting on the implementation and evaluation of two case studies on online interactivity, Boyle and Cook (2001) comment that student attitudes, obtained by questionnaires, do not indicate the quality of debate. However, marks from tutors for individual contributions (performance, albeit marked subjectively) and patterns of exchanges can provide useful information. As is often the case, employing different methods, hoping to converge on a single outcome, is a sensible policy. In exploring online teaching and learning materials in IT for art and design students, Brown, Hardaker and Higgett (2000) assessed their effects through questionnaires asking for student opinions and analysing their performance.

2.2.5 Expert versus user

When gathering subjective judgements, evaluations may adopt a technique from usability studies, heuristic evaluation, or ask for feedback from learners, as discussed above. In heuristic evaluations, a small number of 'usability experts' evaluate the interface against a set of heuristics. This method was used by interface design students to evaluate the usability of sites developed at another university using an online cooperative work environment (Collings and Pearce, 2002). Interestingly this study indicated that expertise

is required if using heuristics based on Nielsen (1994), which may be difficult for beginners in the field of HCI to understand. It is unlikely that this technique would be suitable for a summative evaluation of learning outcomes, although teachers are probably carrying out an informal version of this test when developing material for inclusion in a VLE.

2.3 Measures

A sample of measures are briefly described to illustrate different approaches. In general, what is measured determines the type of data that needs to be collected, the stage of activity to focus on, and who provides the data. The measures are chosen to answer the research question (in the case of an experiment) or provide the appropriate feedback in an evaluation. Issues of usability can be addressed by looking at responses to the system and eliciting perceptions. Learning is generally assessed through outcomes, but perceptions may again be informative. There may also be interactions between the usability of the system and the nature and extent of learning. Therefore comparing participation in discussions may contribute to assessing the role of the interface in the facilitation of learning.

2.3.1 Usability heuristics

This method is described in 2.2.5 and is distinguished from other measures by using an expert (or semi-expert) to conduct the evaluation. Although limited in many respects in comparison with other methods, this technique is efficient and may identify potential difficulties at an early stage without inconveniencing users. It may therefore be appropriate as an initial check before carrying out other sorts of evaluations.

2.3.2 Frequency of interactions

Jones et al. (2000) argue that interactions with the software are important to understanding the learning process. Logs of usage might include the use of resources and participation in discussion (Woods and Keeler, 2001; Holt et al., 2002).

2.3.3 Quality of interactions

Assessing frequency of contributions to discussions fails to differentiate between queries or comments, different topics (relevant or not), depth of debate, clarity of argument etc. If tools are employed and specific tasks carried out, it may be relevant to look at *how* these are used. Woods and Keeler (2001) report that dialogue accounted for 25% of the overall mark in the course they evaluated. This was graded on frequency, quality and timeliness. Judgements of quality are necessarily subjective, as are the majority of teachers' assessments (e.g. learning outcomes). Providing a set of criteria on which variables such as quality are judged can be helpful for future evaluations of this nature.

2.3.4 Learner perceptions

A range of variables can be measured by asking learners for their perceptions. Attitudes are sometimes separated out from perceptions (e.g. Jones et al., 2000), but essentially both are measured by asking for an opinion or judgement. It is the focus of the question that differs. This may be satisfaction, estimates of how much they have learned, usefulness of tools in the VLE, etc.

2.3.5 Learning outcomes

These are an essential measure of a VLE that supports learning, but there can be difficulties in interpreting the results. As mentioned in 2.2.1, it may not be possible to attribute changes in outcomes to specific elements of a learning technology. Nevertheless, studies may provide indicators of variables which may be important and these can provide the basis for future experiments.

The particular aspect of performance that is measured is determined by the objectives of the course, and is therefore likely to vary across studies. However, if measurement is limited to the defined objectives, the evaluation may fail to identify other incidental learning which may take place. Oliver (1997) introduces a dimension labelled 'domain independence' which relates to this distinction. He points out that learning outcomes can be related to the specific subject, or be more generic, e.g. organising discussion. There may also be subject-specific outcomes which are not specified or anticipated by the teacher, but would be worth identifying.

3. Summary of framework

The above discussion of the nature of evaluation is summarised in the following two tables. The framework is not intended to be exhaustive, but provides a method of positioning studies within the broad range of evaluations of VLEs that are conducted. Table 1 combines the purpose and methods of evaluation in the form of a matrix. Although the dimensions are broken down into distinct categories (i.e. evaluation or experiment,

process or outcome measures), studies may incorporate elements of each.

Table 1: Framework for distinguishing between evaluation studies based on their purpose and the methods that are used

			Purpose			
			Specificity/study design		*Discipline/focus*	
			Evaluation	Experiment	Usability	Learning
Methods	*Stages*	Process				
		Outcome				
	Type of data	Qualitative				
		Quantitative				
		Subjective				
		Objective				
	Participants	Expert				
		User				

The second table (Table 2) takes the sample of measures discussed in 2.3 and indicates which methods apply. The table can be read in this direction (i.e. down the columns) or across the rows to provide examples of measures which generate, for example qualitative, subjective data.

Table 2: Methods used in measuring specific aspects of VLEs

			Measures				
			Usability heuristics	Frequency of interactions	Quality of interactions	Learner perceptions	Learning outcomes
Methods	*Stages*	Process		✓	✓	✓	
		Outcome	✓			✓	✓
	Type of data	Qualitative	✓		✓	✓	
		Quantitative		✓		✓	✓
		Subjective	✓		✓	✓	✓
		Objective		✓			✓
	Participants	Expert	✓				
		User		✓	✓	✓	✓

4. Pilot study

4.1 Theoretical position

The pilot study is part of a research project based on a socio-cultural approach to cognition and consequently to learning. Learning is assumed to be socio-cultural in nature. Instead of electing an individual using a system as the focus of evaluation, the research considers that it is the social activity — inside which the system is used — that must be analysed.

Using the concept of *Legitimate Peripheral Participation* (Lave and Wënger, 1991), learning is defined as a consequence of members of a community engaging in a given activity. It is assumed that while engaged in the activity the group develops and incorporates knowledge. However, there must be a purpose or motive for such activity. Members take part in the activity because they have mutual objectives they believe will be achieved.

This description is extremely broad and applicable to many different types of social groups, even those not commonly related to any type of learning activity. Within the framework adopted learning occurs, by definition, in any place. Institutions such as schools and universities may be communities that are more specialized in teaching and learning, however learning is assumed to be part of any social practice.

A course may be construed as a social activity. Students and teachers are members of a group performing tasks to achieve their objectives. While engaged in the course members use artefacts such as books, journals, magazines, etc. to perform tasks. A VLE is one possible artefact that is available to the group. Attributes of the interface should be analysed to identify, for example, how efficient and satisfying the system is to use. However, it is insufficient to investigate how the VLE affects activity by only measuring its usability. Clearly, the evaluation activity incorporates various levels of analysis and variables such as ease of use should not be neglected. What

is required, in addition, is to incorporate variables that reflect the social-cultural component of the teaching/learning activity for which the VLE is intended.

4.2 Proposed variables

Since the learning activity is described in terms of Lave and Wënger's concept the research uses three of their variables. These variables are engagement, participation and achievement of goals. Table 3 defines the three variables in general terms.

Table 3: the three variables selected for use in the study

Engagement	The level of commitment a member has towards the activity, which is crucial for the establishment and achievement of objectives. It is measured by the number of utterances made during a chat session and the ratios number of utterances/number of participants and number of utterances/minute. It is also measured by the frequency with which a participant attends the chat sessions.
Participation	The range of different tasks performed during the activity. It is established by identifying different types of contributions made by the participants within the data.
Achievement of goals	The level of accomplishment of objectives and satisfaction with the activity. Questionnaires and course assignments are the source for the data.

The focus of the study is the social activity itself. This is defined as a group of individuals who join together to perform tasks to accomplish their objectives. By making the social activity the focus of the research, the evaluation of the VLE is placed within a context. The evaluation is no longer isolated from the situation in which it is used. It follows that making the system's use artificial by carrying out a controlled experiment is not desirable and the study should be as natural as possible. Obviously, any study is artificial at some level. Nevertheless, the pilot was conceived as an experiment using a real online course.

4.3 Method

The pilot uses two independent groups to compare two different VLEs with the same course content. The two systems are Blackboard and VirtusClass, developed at the Universidade Federal de Pernambuco (UFPE), Brazil.

A free online course (Basic Layout) was announced in e-lists of students and graduates from the graphic design programme of UFPE, Brazil. This generated more than 60 responses. After responding to enquiries and arranging the most convenient schedule, two groups were created with 13 students in each. Students used texts, PowerPoint presentations and links to sites. Seven chat sessions were held, during which the course material was discussed.

4.4 Outcomes

This pilot study tested the suitability of the variables. Both quantitative and qualitative data were collected. Unfortunately, a major fault during one VirtusClass chat session caused the loss of 4 out of 7 sessions. Nevertheless, the remaining data was used to inform the design of subsequent studies.

4.5 Engagement

There was a tendency for more engagement with BlackBoard. The *number of participants per session* and the ratio of *number of utterances/number of participants* and *number of utterances/minute* were consistently greater than in VirtusClass.

There may be two possible reasons for this. Firstly most participants were familiar with VirtusClass but not Blackboard and they may therefore have been more engaged by a novel environment. In particular, students found the whiteboard tool exciting. In the first meeting, one of the students asks about this tool[1]:

21	**SV >** I am curious. How will we use the above area?
28	**Lec >** This drawing tool is very cool, but I don't know yet if we will be able to use it.
29	**Lec >** the problem is always the same

[1] The number at the beginning of each line in the table represents the sequence of utterances within the chat session. In this extract the first mention of the whiteboard tool was made in the 21st utterance.

30	**Lec >** how to draw with a mouse
31	**LF >** that's terrific!!!!!
32	**SV >** it's easy, easy...

The second possible reason is the reliability of the BlackBoard system compared to VirtusClass. There were difficulties in connecting to VirtusClass which appeared to upset participants and they clearly got distressed. More than one participant may have dropped out of the course due to these problems.

4.6 Participation

Both environments have different sections where participants can perform specific actions. As a general rule, VirtusClass offers more options for student contributions while BlackBoard constrains them. For instance, in VirtusClass students are given the same status as instructors to post documents to everyone or suggest links to visit. Students can also initiate a discussion thread in the forum by themselves. It would therefore be expected that they would perform a greater number of roles in VirtusClass than BlackBoard. The only exception is the virtual classroom where BlackBoard's participants can use a set of tools — such as the whiteboard — not present in VirtusClass. The different types of participation students can perform in each section are listed in Table 4.

Table 4: Types of participation

Section	Type of participation student can perform	
	VirtusClass	*BlackBoard*
Link references	Access, Post, Search.	Access.
Document section	Access, Post.	Access.
Agenda	Access, Post.	Access.
Forum	Access, Post, Initiate thread.	Access, Post.
Virtual classroom	Chat.	Chat, Draw, Send particular message.

The virtual classroom and the forum seem to be special cases of participation. The dialogue inherent in these sections suggests participation should be analysed in qualitative terms. Stating viewpoints, supporting them, opposing other's perspectives are different types of participation in a dialogue that may be particularly relevant to the learning activity. For instance, the significance of using the whiteboard as a medium for student reasoning seems to be indicated by a passage from the Blackboard group.

After discussing the importance of grids for a layout, the lecturer tried to point out that they should not constrain the design. A grid, the lecturer sustained, can sometimes limit the layout possibilities. Although students kept saying that this was true, every time they rephrased their comments, they appeared not to get the point. This is that some ideas may not occur to designers if they are not conscious of how a grid may constrain the very conception of the layout. Then RS decided to draw the grid himself:

393	RS > well, I will draw then…
394	RS > it lacks the horizontal lines… etc… but on that grid one can make several different layouts

The lecturer reaffirms the advantage of grids and explains his point once more:

401	Lect > that's the great advantage of a grid, right?
402	Lect > it structures and permits variety
403	JB > and this is independent of its complexity...
404	Lect > what I was trying to highlight is that it may, only may, force constraints when not cleverly used.
	…
408	Lect > we must not allow the technique intended TO HELP
409	Lect > to become an OBSTACLE
410	RS > I see! Ok... it is great to keep these recommendations in mind to avoid stupid ideas when designing.

The lecturer then takes RS' drawing of a rectangular grid and draws a circle over it while RS repeats the lecturer's last sentence.

411	Lect > for instance…
412	RS > that's true. it must HELP, and never OBSTRUCT.
	...
415	Lect > all this square structure may very well lead us to avoid even thinking about a rounded picture
	…
419	Lect > notice that the circle may be seen as inside a square
420	RS > that's true.

421	Lect > but we tend not to think about a rounded picture while using a right-angle structure
	...
424	RS > I see... a matter of tendency
425	RS > like a newspaper ... we almost never see non-rectangle graphics.

RS finally seems to appreciate the point, and introduces a new idea about graphics in newspapers. This may be because RS and the lecturer changed their type of participation, which made RS think about the problem in different terms.

4.7 Achievement of goals

The lecturer did not require a formal task and the achievement of goals was restricted to students' impressions:

- "I found the document about calligraphy very interesting" (LL)
- "I really enjoyed the debate we had here" (EA)
- "I found the course incomplete… lacking a conclusion" (JB)

The pilot demonstrated the necessity of assessing the learning outcomes. It was decided to introduce a formal task — the design of a poster — into a second pilot. In addition, a questionnaire will be used to gather data such as personal satisfaction, particular difficulties and impressions about the learning achieved.

5. Conclusions

The pilot helped test the viability of the variables chosen for the study of VLE systems. It also produced valuable information for the design of the subsequent studies. The conclusions may be summarised as follows:

- The variables provide both qualitative and quantitative and objective and subjective data.
- Achievement of Goals needs to be assessed by practical tasks and a structured questionnaire.
- Technicalities such as connection reliability can severely hinder the experiment.

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Cognitive Style and Attitudes Towards Using Online Learning and Assessment Methods

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Abstract: The studies described in this paper sought to investigate several forms of online learning and assessment methods in terms their efficacy in facilitating student learning. The studies also sought to investigate how participants rated each method. Attitudes toward computer-assisted learning were not related to performance on each of the online methods employed, whereas some relationships were noted between cognitive styles and online learning and assessment. Finally, evaluation feedback from participants indicated that each online task was rated positively. Implications of the findings for further implementation of online instructional methods are discussed.

Keywords: Cognitive style, literature search, online discussion, online assessment

1. Introduction

There are numerous clear theoretical advantages of online instructional methods. Firstly, such methods provide for flexible learning, meaning that the student can progress at his or her own pace; secondly, such methods provide the facility for student centred learning, making the student responsible for his/her own learning. Finally, implementing online methods of instruction, means that material can be made available on demand from anywhere at any time provided the learner has the facility for taking advantage of such a system.

A variety of different online learning paradigms are now being utilised across higher education and therefore it would now seem timely to evaluate such systems in terms of their effectiveness. Three online methods are utilised in this paper. These are a literature search, an online discussion and an online assessment system. These three methods were chosen as being representative of the types of tasks students typically engage in through the medium of e-learning. It is also suggested that individual difference factors such as attitudes towards computer-based learning and cognitive learning style may be relevant to include in this investigation. The rationale for this is given below in sections 1.2 to 1.4. However, firstly a description of cognitive style is given.

1.1 Cognitative Style

Riding (1991) suggested that all cognitive styles could be categorised according to two orthogonal dimensions. These are the wholist-analytic dimension and the verbaliser-imager dimension.

1.1.1 Wholist-analytic style

Wholist-analytic cognitive style can be defined as the tendency for individuals to process information either as an integrated whole or in discrete parts of that whole. In practical terms, analytics are able to apprehend ideas or concepts in parts, but have difficulty integrating such ideas into complete wholes. However, wholists are able to view ideas as complete wholes, but are unable to separate these ideas into discrete parts (see Figure 1).

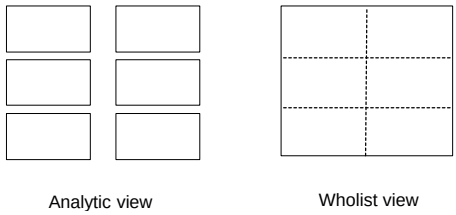

Figure 1: Analytic and Wholist views of information (Riding, 1991)

1.1.2 Verbaliser-imager cognitive style

The verbaliser-imager cognitive style can be defined quite simply as an individual's tendency to process information either in words or in images. Verbalisers are superior at working with verbal information, (Riding and Mathias, 1991; Riding and Watts, 1997) whereas imagers are better at working with visual and spatial information.

Both the wholist-analytic and verbaliser-imager cognitive styles can be assessed using the Cognitive Styles Analysis (CSA) detailed in section 2.2.1 below.

1.2 Online literature search

Searching for information sources online is now a skill with which most undergraduate students have to be familiar. Previous research suggests that the skill of searching for information is in some respects related to cognitive style. For example, cognitive style differences have been noted in searching for information in a database and this topic was investigated by Ford, Wood and Walsh (1994) and Wood, Ford and Walsh (1992). In these studies, searching strategies were classified in terms of relative breadth or depth. A high usage of the operator 'OR' to link keywords represents a relatively broad strategy, whereas a use of 'AND' a relatively narrow strategy. Their results showed that wholistic learners displayed a broader approach than analytic learners, in that they made significantly greater use of OR in searching. However, they also used more truncation than analytic learners, and made more use of 'AND', a finding not in accord with their hypothesis. While the issue of the use of different search strategies between individuals with different cognitive styles seems unsettled, the success rate at searching for information may yield more useful data. It is this issue that the current study seeks to address.

1.3 Online discussion

It would seem to be generally accepted that educational environments where students interact in seminars leads to good collaborative learning. Research shows that there are clear educational advantages to be derived from collaborative learning activities (Del Marie Rysavy and Sales, 1991; Slavin, 1996). When students work in groups and small teams, the interactions and activities frequently involve higher order and reflective thinking. Face to face talk therefore theoretically assists students to share knowledge and interactions often lead to the creation of new ideas.

However, the issues surrounding online discussion are perhaps less well understood. In a traditional face-to-face environment, support for learners can be provided immediately. Yet, with online systems, support for learners in the form of interaction with instructors is not always so immediate.

Furthermore, in computer-based learning environments, the language through which new ideas are expressed are reduced to print and graphics and interactions between learners and instructors are reduced to levels that can be supported by the technology. Also, in online discussion sessions, other factors such as non-verbal cues are removed, making discussion between participants more difficult.

Given these factors it is pertinent to investigate whether attitudes to educational technology and cognitive style are useful learner characteristics to take into account when designing learning environments that include an element of online discussion. This is principally because cognitive style also has a bearing on the way in which individuals interact socially. For example verbalisers are typically more outgoing than imagers (Riding, 1991), therefore it is theoretically possible that verbalisers will be less reluctant to engage in online discussion compared to imagers.

1.4 Online assessment

Online assessment may be defined as a method of using computers to deliver and analyse tests or exams and such systems have been around since the seventies. Yet in many ways the internet provides a new way of delivering assessment material. This is because it is independent of time and place. Assessment can essentially be divided into two types. Firstly, formative assessment at the end of a period of study, whereby the results are used in order to determine examination outcome. Secondly, summative assessment, which is an assessment which may be administered during the presentation of a course as a means of checking on student learning. Furthermore, students may also assess themselves periodically in order to check on progress.

Within any assessment system question types may vary. For example, questions may include short essay type questions, true or false type questions, or multiple-choice questions. There are many potential advantages of online assessment to learners. For example, tests are available on demand and at any time. Furthermore, computerised assessment systems give immediate feedback to the user; therefore users learn by taking the test. However, online assessment systems also have a drawback in that students who perceive themselves as possessing poor IT skills may be disadvantaged. Therefore a study of individual differences in attitudes towards computer-based learning is relevant here. Furthermore, individual differences in approach to different question types have been found between individuals possessing different cognitive styles, (Riding and Read, 1996) and therefore it is possible that this may have an

impact on the success with which they engage with online assessment.

1.5 Summary

In summary then, this study seeks to evaluate by comparing student attitudes towards computer-assisted learning, cognitive style and student feedback, three different types of online learning and assessment methods, an online literature search, an online discussion, and finally an online assessment system.

2. Method

2.1 Participants

Participants in this study were fifty, first year undergraduate university students, (9 males and 41 females). The mean age was 23.24 with a standard deviation of 7.49. Ages ranged from 18 to 46. All participants were single honours psychology students who received credit for participation in this study.

2.2 Instruments

2.2.1 Cognitive Styles Analysis (Riding, 1991)

The Cognitive Styles Analysis is a computer presented test used to determine an individual's position on the Wholist-Analytic and Verbal-Imagery style dimensions. It consists of three subtests. The first contains items relating to the verbaliser-imager style, the second set of items relates to the wholist dimension of style and the third set of items relates to the analytic dimension of style. The test taker is required to react by simply pressing either a 'true' or 'false' button in response to each question item. The computer then calculates an individual's position on each style dimension by comparing response times between the verbal and imagery items and the wholist and analytic items on the test.

Test-retest reliability of this instrument as reported by Peterson et al (2002) is as follows. For the verbaliser-imager scores (r=0.70 p <0.00) and for the wholist-analytic scores (r=0.81, p <0.00). For the purpose of data analysis, WA categories of wholist, intermediate and analytic were identified according to the following scores, $\leq$1.02 wholist, 1.03 - 1.35 intermediate, $\geq$1.36 analytic. The VI categories of verbaliser, bimodal and imager were identified as $\leq$0.98 verbaliser, 0.99 - 1.09 bimodal and $\geq$1.10 imager. This procedure is according to the standardisation scores for this style dimension (Riding, 1991).

2.2.2 Computer Attitude Test (Smalley, Graff and Saunders 2001)

This computer attitudes test developed by Smalley Graff and Saunders (2001) consists of thirty seven items assessing three components of attitudes towards computers, namely, affective, behavioural and cognitive. Responses to each item are made on a five point Likert type scale.

Firstly, internal consistency was calculated using Cronbach's Alpha for each of the three components, affective (0.93), behavioural (0.65) and cognitive (0.65). These coefficients indicate a high level of internal consistency for the each attitude component. Cronbach's Alpha for the original development study are affective (0.95), behavioural (0.71) and cognitive (0.88) and total (0.95). Correlations were calculated for the scores between each of the four components, and with the total score. These are shown in table 1 below.

Table 1: Correlations between attitude components

	Behavioural	**Cognitive**	**Total**
Affective	0.52**	0.76**	0.94**
Behavioural		0.74**	0.75**
Cognitive			0.90**

** p<0.01

The correlations between the scores on each of the four components of the scale and with the total score indicate that the components and the scale are significantly correlated with each other. All correlations reach significance at p<0.01, illustrating that each component contributes to the total score.

Test retest reliability from the original development study (Smalley, Graff and Saunders 2001) is (r=0.84 p <0.001).

3. Online literature search

3.1 Procedure

This study involved an online search whereby participants were required to retrieve information in response to fifteen questions, the answers to which could be found on the WWW. Typical tasks involved retrieval of simple pieces of information such as the names of journal editors etc. Participants were awarded 1 point for each completely correct

answer to any of the questions. No strict time limit was set for the search activity.

3.2 Results

3.2.1 Attitudes to computers

Firstly, Table 2 presents the correlations between each attitude component and total attitude score with the scores achieved for the literature search. None of the correlations are significant indicating no relationship exists between attitudes to computers and the literature search task.

Table 2: Correlations between attitudes to computers and scores for the litertaure search task

	Affective	Behav-ioural	Cognitive	Total Attitude
Literature Search	**0.06**	**-0.07**	**0.01**	**0.03**

3.2.2 Cognitive style

Figure 2 displays the mean scores for literature search task performance and wholist, intermediate and analytic cognitive styles.

Figure 2: Wholist-analytic cognitive style, and scores for search performance

Intermediates performed best whereas wholists performed least well. A one-way ANOVA was carried out for wholist, intermediate, analytic cognitive styles for search performance scores, however, the results did not reach significance.

Figure 3 displays the mean scores for literature search task performance and verbaliser, bimodal and imager cognitive styles.

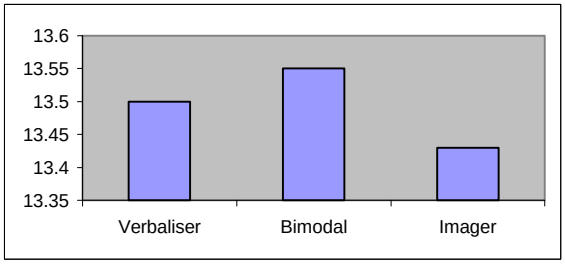

Figure 3: Verbaliser-imager cognitive style, and scores for search task performance

Bimodals performed best whereas imagers performed least well. A one-way ANOVA was carried out for verbaliser, bimodal and imager cognitive styles for search performance scores, however, the results did not reach significance.

3.2.3 Student Evaluation Questionnaire data

Finally, Figure 4 shows participant ratings for the literature search task.

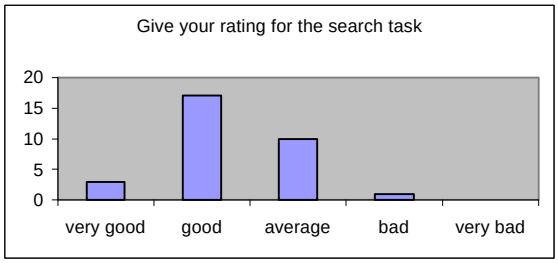

Figure 4: Student ratings for library search task

No statistical analysis was performed here, however, the results illustrate that most participants rated this type of task as good.

4. Online discussion

4.1 Procedure

This study involved students engaging in an online discussion about a question set by their lecturer. Students were awarded a score for the amount of substantive discussion engaged in during this task.

4.2 Results

4.2.1 Attitudes to computers

Table 3 presents the correlations between each attitude component and total attitude score with the scores awarded for the online discussion. None of the correlations are significant indicating no relationship exists between attitudes to computers and ability at the online discussion task.

Table 3: Correlations between attitudes to computers and scores for the online discussion task

	Affective	Behav-ioural	Cognitive	Total Attitude
Online Discussion Scores	**0.01**	**-0.02**	**0.10**	**0.02**

4.2.2 Cognitive style

Figure 5 displays the mean scores for the online discussion and wholist, intermediate and analytic cognitive styles.

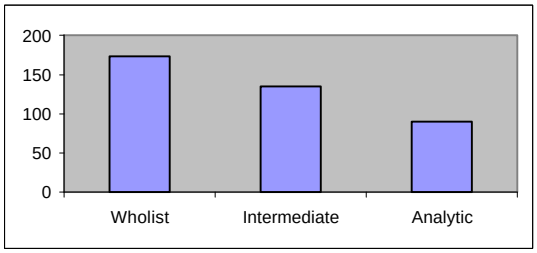

Figure 5: Wholist-analytic cognitive style, and scores for online discussion

Intermediates performed best whereas wholists performed least well. A one-way ANOVA was carried out for wholist, intermediate, analytic cognitive styles for search performance scores, however, the results did not reach significance.

Figure 6 displays the mean scores for the online discussion and verbaliser, bimodal and imager cognitive styles.

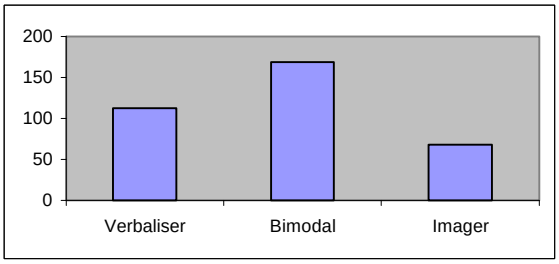

Figure 6: Verbaliser, bimodal, imager cognitive style, and scores for online discussion

Bimodals performed best on this task, whereas imagers performed least well. A one-way ANOVA was carried out for verbaliser, bimodal and imager cognitive styles for online discussion scores. An effect approaching significance was observed ($F(2,40) = 3.11$, $p = 0.06$). A Tukey post hoc test indicated significant differences between bimodals and imagers. However, there were no significant differences observed between verbalisers and bimodals or between verbalisers and imagers.

5. Online Assessment

5.1 Procedure

This study involved participants answering questions online regarding information from a module they were taking. A variety of question types were utilised in this part of the project which were free response, true / false questions, multiple-choice questions and an essay question. Some questions gave immediate feedback on the accuracy of the answer and others did not. Participants were awarded points for correct responses. No time limit was set for this activity.

5.2 Results

5.2.1 Attitudes to computers

Table 4 presents the correlations between each attitude component and total attitude score with the results for the online assessment. None of the correlations are significant indicating no relationship exists between attitudes to computers and results for the online assessment.

Table 4: Correlations between attitudes to computers and scores for the online assessment

	Affective	Behav-ioural	Cognitive	Total Attitude
Online Assessment Scores	**-0.22**	**-0.10**	**-0.18**	**0.28**

5.2.2 Cognitive style

Figure 7 displays the mean scores for the online assessment and wholist, intermediate and analytic cognitive styles.

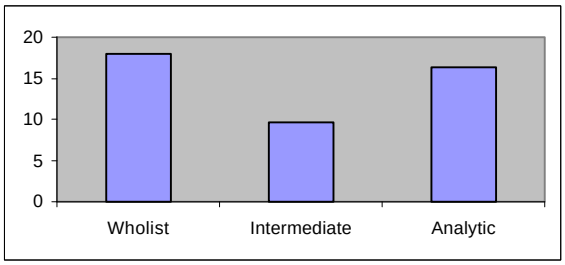

Figure 7: Wholist-analytic cognitive style, and scores for online assessment

The performance of wholists and analytics was approximately equal although the performance of intermediates is inferior to the other two styles. A one-way ANOVA was carried out for wholist, intermediate, analytic cognitive styles for online assessment scores. A significant

effect was observed here, ($F(2, 38) = 3.91$, $p < 0.05$). A Tukey post hoc test indicated significant differences between wholists and intermediates. However, there were no significant differences observed between wholists and analytics or between analytics and intermediates.

Figure 8 displays the mean scores for the online assessment for verbaliser, bimodal and imager cognitive styles.

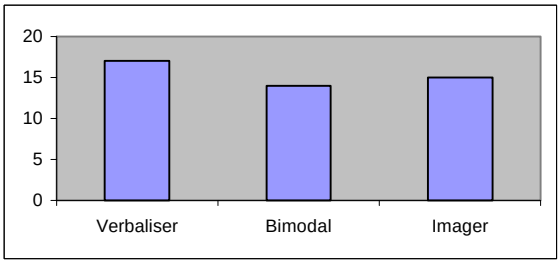

Figure 8: Verbaliser, bimodal and imager cognitive style, and scores for the online assessment

Very little difference can be observed between verbalisers, bimodals and imagers. A one-way ANOVA revealed no significant differences between cognitive styles.

5.2.3 Student Evaluation Questionnaire data

No statistical test was performed for this part of the study, however, Figure 9 shows participant ratings for the online assessment. The results illustrate that the general response to online assessment was generally good.

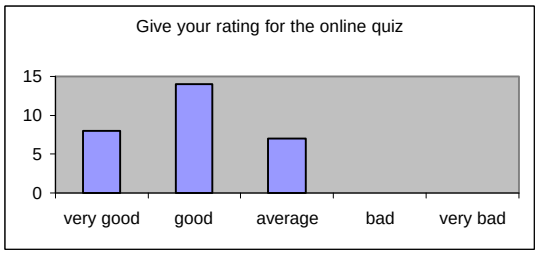

Figure 9: Student ratings for online assessment task

6. Discussion

The overall findings from this investigation suggests that attitudes toward computers are not related to performance on each of the online tasks employed here, although there are some connections between cognitive style and performance on these tasks.

For the online search task, the results show no relationship between attitudes towards computers and performance at this task. Similarly, the results show no differences in performance on the online search task for participants identified as possessing different cognitive styles. The findings of Ford, Wood and Walsh (1994) and Wood, Ford and Walsh (1992) suggested that individuals possessing different cognitive styles employ different search strategies. If this were the case in this study, then this did not result in differences in performance. The evaluation questionnaire data for perceived usefulness of this task however, suggests that the majority of participants found it useful.

For the online discussion, the results again show no relationship between attitudes to computers and online discussion performance. However, for cognitive style wholists outperformed analytics, which is consistent with the idea of wholists, being typically more outgoing than analytics (Riding, 1991). Furthermore, a relationship approaching significance was noted between and cognitive style and the online discussion task, with bimodals outperforming verbalisers and imagers. On a more practical note, several issues were encountered in the implementation of this activity. Firstly, it took students a little time to get used to this system of online discussion, when they were more used to face to face interaction. Furthermore, management of such a system of seminars required extra time from the tutor in judging just when to contribute a comment in order to keep the discussion active. However, one of the advantages of this activity was that because the tutor monitored the contribution to the discussion by students, all students were encouraged to contribute. Those who might naturally be more reserved had the opportunity to consider their contributions rather than being forced to make them too spontaneously. More work on the techniques involved in such a system is however needed in order to make improvements.

For the online assessment, the results revealed, as with the above tasks, that no relationship was evident between attitudes to computers and performance. However, a significant effect was noted for wholist-analytic cognitive style with analytics and wholists outperforming intermediates. This would seem therefore to be an important consideration for the design of such systems. No differences were observed between individuals with a verbaliser bimodal or imager style. Further research looking at the methods of online assessment would need to focus on the types of questions preferred and performed best by

individuals with different cognitive style characteristics.

Generally, it is suggested that the overall culture of using online methods for instruction is an issue which needs to be assessed. Traditionally, courses are taught without online support, and one of the areas would seem to involve educating students to utilise online methods more readily.

7. Conclusion

This study looked at three different areas of online delivery and methods of assessment, which were online searches, an online discussion and an online assessment system. These methods were chosen as being the types of task with which learners would typically engage throughout higher education. In terms of individual differences in the efficacy of such methods the results may be summarised as follows. Few differences were found on each of the three tasks between individuals with differing attitudes towards computers. However, some differences were found between individuals identified with different cognitive styles. Evaluation of the methods used from the participants in this study was generally positive.

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Biomedical Online Learning: The route to success

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Abstract: The potential of the World Wide Web for rapid global communication is driving the creation of specifically tailored courses for employees, yet few practitioners have the necessary experience in on-line teaching methods, or in preparing documents for the web. Experience gained in developing six online training modules for the biotechnology and pharmaceutical industry sectors is informing the development by a partnership of academics and practitioners of seven online modules that will meet requirements for continuing professional development in the health sector. This paper highlights lessons for success.

Keywords: Biomedical Online learning; experience; solutions; training

1. Introduction

In the UK, the enormous potential of the World Wide Web for rapid global communication is driving the creation of electronically delivered courses by both commercial and educational organisations alike. Some of the perceived opportunities are highlighted in table 1.

In the early stages of this climate change in education using the Internet, a group of academics from the University of Greenwich teamed up with representatives from the biotechnology and pharmaceutical industry sector. Their goal was to up-skill employees in the industry sector using web-based methods and they obtained £500,000 from the South East Development Agency (SEEDA) for this purpose. Six on-line training modules were created in the BioPharm Skills Project and these are now marketed through the Royal Society of Chemistry (www.gre.ac.uk/biopharm) for CPD. Experience gained from this project led to the initiation of the Biomedical Online Learning Project (BioMed). Funded by a consortium of six different Workforce Development Confederations, its objective is to develop and deliver six flexible training modules to meet the CPD requirements of Healthcare Scientists within the NHS. Workforce Development Confederations were established on 1 April 2001 following consultation on A Health Service of all the Talents [3]. They bring together local NHS and non-NHS employers to plan and develop the whole healthcare workforce.

This paper examines the lessons learned from the delivery of these two projects and highlights those aspects considered to merit particular attention for the successful creation and delivery of an online course.

Table 1: Perceived opportunities from the creation of online learning courses

International recruitment and income generation.	The global market for higher education is estimated to stand at £300 billion per year. David Blunkett the former Minister for Education, urged that we "use the competitive advantage we have been given by the English language and the international reputation of our higher education system to make major strides in (international recruitment) markets" [1].
Compliance with Government policy.	The policy document Higher Education for the 21st Century states that "Higher education has a major contribution to make to lifelong learning, but access must be widened to include those who have traditionally been under-represented in our colleges and universities" [2]. Education delivered under the umbrella of "any time, any place" using the Web may reach these groups.
Student retention.	Increasingly, students expect to learn in a technology rich environment and have high expectations for using technology in their studies. At another level, there are also more students than ever before looking for part-time jobs to support their education. For them, the flexibility afforded by taking an online course is highly advantageous.
Continuing Professional Development (CPD)	The Lifelong Learning Framework for the NHS in England, 'Learning Together-Working Together' (http://www.doh.gov.uk/lifelonglearning/index.htm) has led to major demand for CPD throughout the NHS. However, financial and workforce constraints make it difficult to release employees from regular duties, and shift work hampers regular attendance at the location of CPD course providers.
Specifically-tailored courses	For commercial organisations, use of the Web offers the opportunity to provide specifically-tailored training for employees on a global scale.

2. Scope of the problem

The development of a successful online course is not a trivial task –it requires significant inputs in both cost and time. Several logistical component parts need to be addressed, and this may require contributions from a variety of different experts at different stages during evolution, as illustrated in Figure.1.

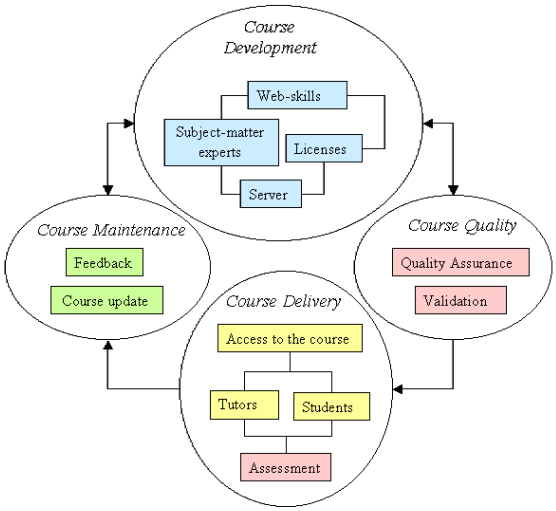

Figure 1: The steps required in creating and delivering an online course, and the interrelationship between each.

Since materials will be published on the Internet, licences and copyright clearance may be required. The courses need to be evaluated to ensure they meet quality assurance and accreditation standards. Arrangements need to be made to ensure that both students and tutors can access the course materials. The courses need to be regularly maintained and updated, particularly if they include links to other web-sites over which course designers may have no control.

We decided that our courses were to have the following characteristics:

- They required content to be organised, and developed where necessary, by subject matter experts who in turn needed to be able to identify and make use of the best of the different teaching resources available i.e. texts; e-journals; image databases; stand-alone CDs.
- They needed to elicit interaction between tutor and students as well as between students via the Internet
- They needed to meet quality assurance criteria of the university and were to be accredited by professional bodies.

3. Lessons learned for the successful creation and delivery of an online course

3.1 Establish a Partnership

Our first priority was to pitch the choice of course where there was a clear need. We found that the best way to do this was through creation of a partnership between those able to create courses and those with a need for courses.

The BioMed project started life as a partnership between academic practitioners skilled in delivering high quality training using web-based e-learning methods, and specialists and practitioners from the health sector with a firm grasp of the needs and skills gap in hospital and public health laboratories. These laboratories are responsible for investigating samples of tissue and body fluids to diagnose disease and monitor the treatment of patients, and to advance research into the causes and cures of disease [4].

When funding became available, a Steering Committee was created, made up of representatives from the University, Laboratory Managers from 16 NHS Hospital Trusts, the Public Health Laboratory Service (PHLS) and the 6 Workforce Development Confederations funding the project. Representation as observers was invited from the professional and regulatory bodies (the Institute of Biomedical Science (IBMS) and Health Professions Council, HPC) as well as the NHS University.

The BioPharm Skills project, on the other hand, developed a partnership between academics and industry representatives from the biotechnology and pharmaceutical industry sectors once funding had been obtained.

Partnership has afforded a number of advantages:

- Funding. In the case of the Biomed Project, the bid for funding was developed by the partnership over several months and resulted in a proposal that was difficult to ignore.
- Appropriate choice of course to meet the needs of the end-user.
- Guaranteed students for trials
- Shared responsibility. With few precedents in place for developing an online course, we needed to gather information and experiment with ideas. Working together in partnership meant that problems were shared and the responsibility for the outcomes has been a joint one.

3.2 Engage institutional support before commencing

At all stages of online course creation and delivery there are numerous issues to be resolved, such as:

- A web server on which the course will be located
- A webmaster to manage the chosen Information Communication (IC) platform
- Support from web page designers
- Computer/Internet support for the distant student
- Licensing arrangements for electronic resources
- Registry support to enrol students
- Legal advice on course ownership and copyright of materials

The best way to resolve these varied issues is to engage support for the goals before commencing course creation. This way, terms of reference can be established and contracts drawn up to ensure clarity and support. This is particularly important in managing the inevitable technology failures that occur, so that students do not lose confidence in using the technology whilst receiving online training.

3.3 Establish the objectives of the course

The partnerships for both the BioPharm Skills and Biomed projects reached the same conclusion that CPD courses were required for employees, but, as illustrated below, course popularity has differed markedly, reflecting the need at any one time for this type of training.

In the case of the BioPharm Skills partnership, a need to up-skill employees and improve their written and spoken communication skills was identified at the time of starting course creation. Six specifically tailored training modules were developed (Table 2), and each was accredited through EDEXCEL [5] for a Certificate of Achievement leading to the award of an EDEXCEL Professional Development Certificate in BioPharmaceutical Sciences. During trials, employees found the technology relevant and highly motivating, and the standard of their learning output was high. Despite their obvious popularity, however, the number of paying students registered on these

courses is low. The major stumbling blocks seem to be

- a reluctance on behalf of employers to pay for this type of training in the present economic climate and
- a concern amongst employees that personal investment in these courses will not lead to career advancement.

In the case of the Biomed project, however, a timely decision was made to create modules specifically aimed at providing CPD for state registered personnel; supplementary training required for registration for those holding non-approved degrees, and academic accreditation towards Masters level qualifications in biomedical sciences. The decision was reached after realisation by the partnership that

- Biomedical laboratories, and pathology services in particular, were the subject of major modernisation proposals and that training programmes needed to be more strongly aligned with NHS service requirements and the provision of care around the patient [6-8];
- there was a real need to attract and retain laboratory scientists to the profession. One way of achieving this would be to offer flexible learning programmes for CPD, which would also develop top class staff.

Shortly afterwards, the lifelong learning framework for the NHS in England, 'Learning Together-Working Together' [9] was published, which made evidence of CPD compulsory throughout the NHS.

Seven modules for meeting CPD requirements in the NHS are now being created, for demonstration purposes (Table 2).

Each module will be subjected to a trial using six employees from biomedical laboratories. The trials will be designed to

- test the quantity and suitability of course material;
- evaluate the appropriateness of this approach to training for employees,
- ascertain the reaction to this type of training from employees in the sector, and
- determine if additional modules should be developed.

Table 2: Courses chosen for online development and delivery

	CPD Courses	Market
BioPharm Skills	Bioinformatics Pharmaceutical Analysis Drug Design and Delivery Regulatory Issues Enzymes Microbial Growth	Employees in biotechnology and pharmaceutical industry
BioMed Online	Hospital Acquired Infection Point of Care Testing Laboratory Skills Management Biology of Disease: Respiratory Biology of Disease: Renal Breast Cancer Genetics	Healthcare scientists within the NHS

3.4 Provide appropriate support to course content creators for course construction

Academics, in the main, were employed to create the BioPharm Skills modules, and for the Biomed modules, practitioners from the workplace were used. However, for both cohorts of content creators, the same problems needed to be surmounted. Course authors demonstrated

1. knowledge of the subject and enthusiasm for the concept, but they had little or no time available during the working day to commit to course construction;
2. experience in face-to-face teaching but no experience in on-line teaching;
3. some experience in using the Web, but little or no experience in preparing documents for the Web.

Most of the authors were attracted to the project because they wanted to learn how to use the teaching method, all were surprised how long it took to become expert in the software. They had varying degrees of IT expertise and educational backgrounds and this also added to the complexity of project management.

In the case of the Biomed project, all authors found the stressful life of today's health service to be less than an ideal backdrop to finding quality time to engage in this work. Interestingly one module had a retired member of staff with a little more time than her collaborators. Her various documents were worked on interactively with the module leader

and helped the others in agreeing style, layout and content.

There were also geographical problems with organising the course in that authors were based in many different parts of London and the South-East of England. Face to face discussions were on occasion needed.

In an attempt to solve the problem of time, authors for both projects were paid to either prepare the materials in their own time or to buy out their time from the workplace.

To tackle the problem of the lack of online course design experience, a compulsory training programme was created for authors on the Biomed project, comprised of two components:

1. Face-to-face practical training to equip authors with the practical tools necessary to publish course materials on the Internet; and
2. On-line training (approximately 40hours training conducted over eight weeks) designed to
   - provide experience of being a student on an online course;
   - provide a forum for discussion;
   - facilitate course planning and development;
   - provide tips, support and guidance on how to make the online training modules interactive and motivating;
   - provide insight into what constitutes good online teaching;

Authors were required to enrol on the programme before commencing construction of the course materials, so that they would be empowered to

- design for the on line medium, conscious of all the facilities on offer (asynchronous and synchronous communication tools; image databases; quizzes and so on);
- appreciate problems of computer access as a student;
- recognise the level of frustration that is experienced when web-links don't work;
- experience the power of interaction between students and with a tutor;
- appreciate the problem of meeting course deadlines in the face of limited time within the working environment.

Participation by the authors on the on-line training programme provided insight into problems that we had not envisaged. For example,

- The Internet delivery systems and computer access within the NHS could be tested in advance of the delivery of CPD modules to students. As a result, a number of problems for online course delivery within the NHS were identified. In particular, we have encountered serious problems associated with firewalls associated with NHS.net that have affected course access using synchronous communication tools;
- Internet skills amongst authors were more limited than anticipated.

The biggest problem we encountered, however, was the limited amount of time that course authors were able to commit to their participation on the online course, according to the recommended timetable. Consequently remedial action in the form of engaging additional support to prepare html documents was necessary in order to meet the project timelines. Course authors were nevertheless, keen to learn the necessary skills required for publishing materials on the Internet. Therefore the course timetable was significantly modified to provide them with support in course design early in the programme. Support in creating and designing web pages was in turn timetabled for when their own online courses were completed. This way, authors were still equipped with the necessary tools to update the courses at a later stage, as required.

3.5 Provide guidelines for Quality Assurance to course authors

Subject matter specialists were hired by the Steering Committee from a field of peers recommended by the course designers, to review the modules and report on the following matters:

- Integrity of content matter
- Academic standard
- Consistency and continuity of materials
- Typographic and grammatical errors

In addition, they were required to report on the extent to which the modules met quality assurance criteria for an online course, which needed to be defined. In turn, authors were supplied with accreditation criteria of the University and of the professional bodies and checklists of the sort shown below (Table 3).

Table 3: Checklist for authors for quality assurance of an online course.

	Yes	No
Clear guidelines for interactions with students?		
Well-designed discussion assignments?		
Challenges for students e.g. opportunities to choose and present course projects or sample cases?		
Opportunities for tutors to provide feedback: information feedback and acknowledgment feedback?		
Presence of course assignment deadlines?		
Assignments that minimise the risk of plagiarism from students?		

3.6 Implement a plan to maintain the courses

Online courses afford the opportunity to publish rapidly and respond to new developments in the field. They may also make extensive use of web-links to remote Internet sites, which frequently become out of date or are no longer active.

To solve the problem of course maintenance, tutors who were hired to deliver the courses were required as part of their contract, to upgrade and maintain the course web pages each time the course was offered. By publishing the date that the page was last upgraded, they also enlisted confidence of the student in meeting their CPD requirements.

4. Biomedical Online Learning

The Biomed project has thus far highlighted strong commitment by all partners to develop online courses for meeting CPD requirements in the health sector, and has been driven by a clear need to supply training in an environment characterised by staff shortages. It has also identified considerable enthusiasm amongst practitioners to participate in course development, not least because of the opportunities afforded to them to provide specifically tailored training to meet an acknowledged skills deficit. However, work in progress has also identified that

- the level of IT skills amongst course designers is much more variable than originally envisaged; and all have little or no experience of how to create an online course;
- the presence of firewalls associated with security considerations within the NHS will seriously hamper course delivery and online tutor support;
- in the short term, limited availability of online workplace computers may constitute a limitation to the ready participation of students on the courses ‘any time, any place’.

5. Conclusions

Online Course design and delivery is not for the faint-hearted, but with institutional support and a carefully constructed partnership willing to work together to achieve a common goal, many of the problems that will inevitably be encountered, will be solved.

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Interactive Technology Impact on Quality Distance Education

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Abstract: This paper reports on a study to determine if existing technology is adequate for the delivery of quality distance education. The survey sample was 392 respondents from a non-traditional graduate level. The study included 15 descriptive questions on course assessment and satisfaction. The three hypotheses used Chi-square to find relationships between interactivity and three other variables: progress, communication mode, and the desire to take another course. Responses showed that taking a distance education course was worthwhile. Findings, recommendations and conclusion are included.

Keywords: Distance Education, Quality, Interactive, Technology Assessments, E-learning, Interactivity

1. Introduction: Stating the Problem

There are many problems associated with traditional education, including students' tardiness, schedule conflicts, unavailable courses, geographical isolation, changes in demographic and economic issues, and other obstructions that preclude students from attending traditional classes. This study points towards a need for an alternative education method to complement the traditional system.

Many definitions of distance education were uncovered, but most authors agree on the concept of student and instructor separation in time and place (Dalziel 1994; Moore & Kearsley 1996; Willis 1993).

In answering the question "Why teach at distance?," Gottschalk (1995) showed that distance education is a valid concept in which students could have access to education that they would not otherwise have available. Students could benefit from the participation of experts and skilled people available through distance education who might not be available locally. In addition, students could create a stronger bond with each other and share their distance education experiences.

2. Purpose of the Study

The research study attempted to evaluate the use of technology from the students perspective to deliver quality education over distance. The purpose of the study is to determine if technology has reached a level of adequacy to support the delivery of quality education regardless of time and place constraints of students and/or instructors. In addition, this study will endeavor to find which technological innovations provide students and instructors with a satisfactory degree of interactivity, which is the basis of traditional education.

3. Significance of the Study

This research may be important to those who are concerned about how technology should be included in the decision-making process of establishing distance-learning projects. Institutions exploring the myriad of technological innovations that could be used in distance education may also benefit from the study. Developing concrete insights on distance education may enable institutions to better balance their traditional on-sight programs with non-traditional distance education alternatives.

This study may or may not point out the importance of using technology to establish a distance education project. If it proves vital, then the results could be of value to institutional decision-makers.

4. Review of Literature

4.1 Definition of Distance Education

Distance learning has multiple definitions. The author of Distance Education Clearinghouse

(2002), which managed by the University of Wisconsin-Extension, compiled few definitions of distance learning. The author concluded that distance learning is a planned environment; involving the use of technology, and its design should provide the learners with interaction.

4.2 Link of Technology with Distance Education

This section deals with the issue of how technology has impacted distance education. Gates (1995) stated that people might fear that technology would "dehumanize" education. He added that if people could watch students living in different countries and exchanging information across the borders, they might rethink that technology would actually "humanize" education. Gates continued by stating "the same technological forces that will make learning so necessary will also make it practical and enjoyable. Corporations are reinventing themselves around the flexible opportunities afforded by information technology; classrooms will have to change as well." (p. 184)

4.3 Quality Distance Education

Since quality education is a concept that varies among individuals, it is hard to agree on a definition of quality in education. Aldag and Stearns (1991) suggest that quality is what a consumer wants from products and services and is willing to invest in. Moore and Kearsely (1996) discussed "quality assessment" as an important factor in the process of managing a distance education project. The authors stated that a distance education project should be assessed based on several factors. These include "quality of application and enrollment, student achievement, student satisfaction, faculty satisfaction, program or institutional reputation, and quality of course materials. Each of these factors reflect different aspects of quality" (p. 182).

4.4 Distance Education and Interactivity

De Vries (1996) stated that systems, which support interactivity between students and instructor, could generate a satisfactory learning environment. Schwier (1994) discussed the reasons for including the interactivity factor in distance education projects. These reasons include:

(a) finding different methods of accessing the materials;
(b) requiring interactive media analysis;
(c) producing stronger learning environments, since multiple media can be combined;
(d) increasing student retention rates;
(e) creating an independent study environment;
(f) providing instant access to information;
(g) ensuring a less hostile learning environment;
(h) improving record keeping and
(i) reducing costs.

4.5 Technology, Delivery Systems and Distance Education

This section discusses the electronic devices, and the delivery methods used in distance education. McLean (1996) stated that by using technological innovation, classrooms around the globe could be connected through satellite, computers, interactive TV, and the Internet. Brennan (1992) stated that telecommunication could provide new links between the learners and the instructor. The author added that the term "interactivity" is associated with the field of telecommunication.

Lucio Teles (2002) who surveyed 32 online instructors from United States, Mexico, Canada, Netherlands, Greece, Colombia, Australia, South Africa, the United Kingdom, and Spain stated that instructors preferred instructional tools that are intuitive and require less time to learn. Further, Morse (2002) stated that a variety of distance learning methods does exist. These approaches range from traditional correspondence courses to real time interactive videoconferencing. In delivering distance education, the varieties of modes include print (Bates 1995), e-mail and facsimile (Romiszowski 1993), video conferencing, interactive video technology (Buntzman 1996), audio graphics (Steiner 1997), teleconferencing and audio conferencing (Patton-Bennington 1997), and the Internet. (Glossbrenner & Glossbrenner 1996).

4.6 Interactive Technology, and Distance Education

Systems, which supported interactivity, and were expanded to allow the discussion of related issues, could generate a satisfactory learning environment (De Vries 1996). De Vries continued by stating that effective distance education could be achieved when the students have "personal involvement." This section deals with the reasons for providing an interactive environment in the distance

education setting and studies related to interactivity issues in graduate schools.

Salmon (2002) stated that "learners need to be led through a structured developmental cycle for online learning to be successful and happy." Jones (1995) researched the usage of interactive-intercampus telecommunication systems connected through a compressed-video network in Alabama that was used in distance education. Jones concluded his study by stating that technology seemed to be effective and adaptable in providing teachers with better approaches to instruction.

5. Hypotheses Pertaining to This Study

This study explored the following three hypotheses:

Null hypothesis 1:
Student-instructor interactivity and student comparative progress are statistically related.

Null hypothesis 2:
The student's belief about adequacy of the communication mode does not vary with its level of interactivity.

Null hypothesis 3:
There is no relation between the student-instructor interactivity and the student's desire to take another DE course.

6. Research Design

6.1 Subjects

The population of students for this study is pursuing a graduate degree education through non-traditional means. Target subjects are graduate students who undertake distance education classes, appear to have technological competence, and who attend the Troy State University System (TSU) at a variety of campuses. The TSU database shows that there are about 400 graduate students who may be eligible and available to participate in this survey, given that in non-traditional campuses, student mobility is high.

This sample may show some limitations that could be stated as follows:

1. Diverse Educational Background. The surveyed students attended different undergraduate colleges and universities. Their educational background was varied, as was their degree pursuits.
2. Age of the Students. Since non-traditional graduate students tend to be older than traditional graduate students, their exposure to technology may vary. Their appreciation and views of the existing technology to deliver quality distance education could be affected by the degree of their experience.
3. Different Occupations. Since the surveyed students acquired different skills and knowledge from their jobs and life experiences, their appreciation or the desire to take a course over distance could be affected by these factors.
4. Restricted Geographical Area. The surveyed students attended schools in three states: Florida, Louisiana, and Mississippi. For that reason, this study may not reflect the entire graduate student body in the United States.
5. Other. The inability to obtain information on other characteristics such as cultural, social, psychological testing, and drug testing results may also be delimiting factors.

6.2 Instrument

In order to attain the research objectives, it was decided to mail a self-administered questionnaire to the subjects. The questionnaire consists of 4 sections:

1) A demographic series of questions asking the students about their background, education and preferences.

Qualification question: The initial question in the distance education section of the survey asked if the student has taken a distance education course using technology. If the answer is yes, the student is asked to complete the rest of the survey. If the answer is no, the student is asked not to respond further.

2) The distance education section asked students to self-evaluate their experience with distance education courses (characteristics and worth) on a scale ranging from (1) = extremely inaccurate or disagree very much to (6) extremely accurate or strongly agree. This ordinal scale is well suited to measure the differences in levels of agreement. Further, it should be noted that the variable progress was recoded into CompProgress (Comparative

Progress) as: (1-2-3 = no more progress; 4-5-6= more progress).

3) The section of questions on courses assessments required yes/no answers.

4) Types of technological delivery system used for the distance education course were included in the survey. Respondents had to mark one or more of the delivery methods used in their distance education course. The methods from which they would choose included the Internet, other service providers (AOL, Prodigy, CompuServe, etc.), facsimile, voice mail, two-way-video-two-way-audio, one-way-video-two-way-audio, two-way audio, and printed material via mail.

6.3 Conducting a Pilot Study

A pilot study, using samples of the population base, was conducted to determine the validity of the questions posed in the survey. Upon completion of the pilot study, corrections were made, and the final survey was sent to the target sample of the population. The results of this pilot survey will not be included in the final results.

6.4 Procedure

Students who indicated a desire to participate received a survey package. The package included the survey questionnaire and a stamped, pre-addressed envelope to return the completed survey.

6.5 Data Analysis Remark

The following assumptions are made in the process of evaluating the data. Fink (1995) stated "when independent variables are measured on an ordinal scale, they are treated as if they were nominal….when dependent variables are measured on an ordinal scale, they are habitually treated as if they were numerical" (pp. 49-50).

7. Findings and Discussion

7.1 Returned Surveys and General Characteristics of the Subjects

Of the 396 surveys sent, 253 or 64% were completed and returned. Of the latter, 20% of the students who answered the survey have enrolled and finished a distance education course. The socio-demographics of respondents' shows that 26% of the enrolled were female and 74% were male. Further, while the ages range from 26 to 54 years of old, the mean for the ages was 38.04 years and the median was 37.0 years.

7.2 Use of Delivery Systems

There are large discrepancies among the different delivery systems as can be seen from Table 1.

Table 1: Delivery systems used

Method	Use the method (%)	Do not use the method (%)
Internet	22%	78 %
Other service provider (AOL, etc)	14%	86%
Fax	16%	84%
Voice mail	14%	86%
Two-way video and two-way audio	16%	84%
One-way video and two-way-audio	4%	96%
Printed material via mail	64%	36%

7.3 Assessment of Courses

As seen from Table 2, the distance education course was worthwhile to the majority (84%) of the respondents. Data showed that sufficient interactivity between the student and instructor (64%). A vast majority (92%) of students believed that the content of the distance education course was clear. Distance education courses did not include alternative activities such as a guest speakers, field trips, or live presentations, according to most respondents (88%). They believed that the communication mode used was adequate (74%). Most students (68%) believed that the distance education course was challenging. Most students (74%) were able to apply the knowledge acquired from the distance education course; these results could be influenced by age. Since the students are older, and gainfully employed, they could be using the knowledge gained in the distance education course to adapt it to the working environment. Finally, 82% of students would take another distance education course.

Table 2: Forced Assessment of course

	Yes (%)	**No (%)**
(Q1) Was the course worthwhile	84%	16 %
(Q2) Was there adequate interactivity provided between the student and the instructor?	64%	36%
(Q3) Did the course include other activities such as guest speaker, live presentation, or field trip?	12%	88%
(Q4) Were the course requirement and content clear?	92%	8%
(Q5) After finishing the course, were you able to apply the acquired knowledge, skills, and techniques?	74%	26%
(Q6) was the course challenging?	68%	32%
(Q7) Was the communication mode (internet, etc) the right mode?	74%	26%
(Q8) Would you take another distance education course?	82%	18%

As can be seen from Table 3, 40% of students believe that the distance education was not as rewarding as a traditional education course. Only 42% of students felt that the distance education did offer opportunities to learn more about issues that could not be easily learned in traditional education. The survey showed that 72% of students believed that distance education allowed them to progress faster and further than traditional education. 84% of students felt that the distance education was well planned and laid out. Furthermore, 82% of students believe that the distance education course met their educational expectation.

Table 3: Satisfaction intensity

	Disagree very much	Disagree moderately	Disagree slightly	Agree slightly	Agree moderately	Agree strongly
(Q9) Was DE More rewarding than traditional education?	6%	24%	28%	28%	10%	2%
(Q10) Did DE provide more opportunities to learn?	8%	14%	32%	30%	8%	4%
(Q11) Did DE allow for progress more than in a traditional course?	8%	4%	12%	30%	28%	14%
(Q12) Was DE planned and laid out, with easy to follow directions?	6%	2%	6%	32%	42%	8%
(Q13) Did DE meet your educational expectations?	0%	4%	8 %	30%	38%	16%

Tables 4, 5 and 6 show the results of the remaining sections of the questionnaire.

Table 4: subject distribution over interactivity and comparative progress variables

	Did progress More	**Did not progress More**	**Total**
Adequate interactivity	56.3 %	10.4 %	66.7 %
Inadequate interactivity	18.8 %	14.6 %	33.4 %
Total	75.1 %	25.0%	100.0%

Table 5: Interactivity and communication mode

	Right mode of communication	Wrong mode of communication	Total
Adequate interactivity	58.0 %	6.0 %	64.0 %
Inadequate interactivity	16.0 %	20.0 %	36.0 %
Total	74.0 %	26.0 %	100.0%

Table 6: Interactivity and desire to take another course in DE

	Desire not to take another one	Desire to take an another one	Total
Adequate interactivity	14.0 %	22.0 %	36.0 %
Inadequate interactivity	04.0 %	60.0 %	64.0 %
Total	18.0 %	82.0 %	100.0%

7.4 Summary of Findings

In terms of interactivity between the instructor and the students, there was an important factor in the evaluation of quality distance education, the conclusion from the results showed that:

- Three quarters of the students felt they progressed.
- Three quarters of the students think that the right mode of communication was used.
- Two-thirds reports that there was enough interactivity.

Finally, in terms of interactivity and the communication mode, 58% believed that adequate interactivity was sufficient and provided by the use of appropriate communication mode.

8. Hypothesis Verification

Inferential statistics were used to draw conclusions from three hypotheses. All the hypotheses used Fisher's Exact Test (a derivative of Pearson Chi-square) to infer the relationship between the examined variables.

8.1 Preliminary Remark

It should be noted that Fisher's Exact Test was used for the three hypotheses, since the Pearson's Chi-square might not be accurate (Norušis 1994). Fisher's Exact Test is generated automatically by SPSS as a form of the Chi-square test.

8.2 Hypothesis One: Interactivity and Comparative Progress

The purpose of this hypothesis was to determine whether or not a relationship exists between student-instructor interactivity in distance education courses and the students' progress in the distance education course, compared to progress and interactivity in traditional courses. The conclusion of this hypothesis was to reject the null hypothesis. This indicated that there was a relationship between the student-instructor interactivity and the student's progress in a distance education course at the level of Alpha = .05 (p = .041 < .05). The hypothesis could be retained if the Alpha was chosen to be .01. Finally, the two variables under investigation showed a degree of association since Phi, Cramer's V, and Contingency Coefficient had meaningful results by having close values: .306, .306, and .293, respectively.

Generated results showed that 20% or more of the cells have an expected count less than five. Since this is the case, "the observed significance level based on the Chi-square distribution may not be correct" (Norušis 1994, p. 208). In responding to the issue, the Fisher exact test was used to deal with this limitation. In the article "What is the Fisher's Test?," 1997, the author stated that Fisher's Test is used as a meaningful test to deal with limitations associated with Pearson's Chi-square. The author continued by noting that Chi-square is based on the expected value that is influenced directly by the sample observed. Further, Fisher's Exact Test is not susceptible to low frequency. The SPSS package contains this test, and it prints directly with Pearson's Chi-square. In the article "Fisher Exact Test Online," the author noted that the one side test is legitimate with Fisher's Exact Test. Finally, the exact significance for one side is equal to .041. This result is smaller than Alpha with the value .05. The conclusion is that the null hypothesis is rejected at Alpha

level of .05. Therefore, there is a relationship between the two variables: Interact and Progress. The association tests showed that Phi = .306, the Cramer's V = .306, and the Contingency Coefficient = .293. Even though the measurement of association is not equal, they are of "the same magnitude" (Norušis 1991).

8.3 Hypothesis Two: Adequacy of the Communication Mode and Interactivity

The purpose of this hypothesis is to determine the relationship and the strength of association between the students' belief about the adequacy of the communication mode and the level of interactivity between the instructor and the students. The conclusion drawn from this hypothesis would be to reject the null hypothesis. This indicated that there is a relationship between the student-instructor interactivity and the communication mode used in a distance education course at the level of Alpha = .05 (p = .001 < .05). The hypothesis would still be rejected if the Alpha level was selected to be .01. Finally, the two variables under investigation showed a degree of association since Phi, Cramer's V, and Contingency Coefficient had meaningful results by having close values: .505, .505, and .451 respectively.

It was shown that 20% or more of the cells have an expected count of less than five. Similar to the first hypothesis, Hypothesis 2 will use Fisher's Exact Test instead of Pearson Chi-square. The exact significance for one side = .001. This result is much smaller than Alpha with the value .05. The conclusion is that the null hypothesis is rejected at this level. Therefore, there is a relationship between the two variables "Interact" and "Rightmod," or the two variables are not independent. Further, the association tests showed that Phi = .505, the Cramer's V = .505, and the Contingency Coefficient = .451. Even though the measurement of association is not equal, they are of "the same magnitude" (Norušis 1991).

8.4 Hypothesis Three: Interactivity and the Desire to Take Another Course in DE

The purpose of this hypothesis is to determine if there is a relationship between the level of interactivity supported by using the technology in the distance education course and the desire to take another distance education. Results showed that 20% or more of the cells have an expected count of less than five. Therefore, Hypothesis 3 will use Fisher's Exact Test instead of Pearson Chi-square. The exact significance for one side = .007. This result is much smaller than Alpha with the value .05. The conclusion is that the null hypothesis is rejected at this level. Therefore, there is a relationship between the two variables: Interact and Again, or the two variables are not independent.

A symmetric Lambda coefficient is used. This will allow to "predict the first variable from the second and then the second variable from the first" (Norušis 1991, p. 311). Lambda value for the variable Again = 0. (Norušis 1991) asked the same question "Is it really possible for variables to be related and still have a Lambda of zero? That doesn't sound right. Actually, this can happen easily depending on the distribution of the dependent variable" (p. 312). The used Lambda is symmetric. Therefore, Again and Interact are considered as dependent variables. Further, "since knowing the independent variable doesn't help at all, lambda equals zero" (Norušis 1991, p. 312). This value of Lambda would help a person to conclude that the variable Again would occur whether or not the value of Interact is known (Norušis 1999).

8.5 Impact of these findings

1. Students could expand their educational experience by taking classes over distance.
2. Although more students agreed that the communication mode was adequate at the time of this study, in the future the situation might change drastically. This could be influenced by the proliferation of technology, which will contribute to the technological competence of the student. Thus, students may demand implementation of more sophisticated technological equipment in the educational environment.
3. Since the technological innovations are prolific, a new approach should be considered in purchasing and implementing technology, and in planning and adapting technology to meet institutional goals. This study did not gather data on these important issues that are of value to educational institutions.
4. A quality assessment of a distance education project should include all those who are involved in and concerned about the overall success of the project.

5. As stated earlier, the student body of today and tomorrow will become more technically oriented. The result of this orientation will affect educational institutions and corporations. They will need to understand the potential applications of technology and should include it in their strategic planning.
6. Managers and administrators should support initiatives that emphasize the use of technology to assure the success of the distance education projects.
7. The variety of technology available in the education setting can be applied to other settings to provide for student satisfaction.
8. Planning a distance education project should be flexible enough to accommodate rapid changes in technology.
9. Advances in telecommunication and the computing field will continue to be user friendly, which will allow for the deployment and accessibility of distance education.

9. Final Findings, Recommendation and Conclusion

9.1 Findings of the study

The following points summarize the highlights of the study. These include:

1. A distance education project is a valid and appropriate method for delivering quality distance education.
2. There exists a relationship between interactivity and students' progress in the distance education course.
3. There exists a relationship between the adequacy of the communication mode and the level of interactivity.
4. There exists a relationship between the level of interactivity and the desire to take another distance education course.

9.2 Limits and Recommendations for Further Studies

The following information may point to future research in the attempt to measure quality distance education.

1. Larger samples may eliminate some of the obstacles associated with running the statistics that are encountered in smaller samples.
2. Technological changes are prolific, and there is an ongoing need to create similar studies.
3. Future students will be more computer literate, and assessing their skills should be an ongoing process.
4. Future research on this subject should cover larger and more diverse student populations so generalization of the data can be applied more accurately.
5. Since the definition of quality distance education could vary from one institution to another, other studies could be made by using the statistical analysis of this research to test quality distance education in a specific location.
6. Should other researchers replicate this study, the additional testing would increase and enhance the validity of the questions used in this survey.
7. To obtain results that are similar to this study, an identical environment should be used. Further, because of the exponential growth in technology, it would be difficult to replicate these findings with future graduate student samples.
8. Based on the rate of technology proliferation, designing an effective method to measure quality distance education might include other variables that either were not included in this study or have not yet been introduced.

9.3 Conclusion

Distance education technology is evolving and exponential gains in technology continue to create increasing opportunities for innovation. Therefore, what is current today is obsolete tomorrow. To that end, there is a need for a conceptual model that withstands the changes in technology, economy, and the environment.

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Abstract: This paper addresses some key design issues in e-learning, and its integration with knowledge management. The underlying premise is that the purpose of e-learning is useful knowledge, and that the design of e-learning should therefore be integrated with the design of related knowledge management – particularly personal knowledge management. e-learning will be explored using the notion of "distributed learning". Knowledge management will be explored using the notion of "just-in-context knowledge", emphasising both the contextual underpinning of knowledge, and its strategic value – that is to say its applied value, and its embeddedness in decision making processes. The potential for distributed learning to optimise shared resources is also explored.

Keywords: Distributed learning, e-learning, knowledge management, just-in-context knowledge management, digital learning, blended learning.

1. Introduction

This paper is based on work in designing and building learning materials and environments in a variety of contexts:

- Knowledge bases for community and vocational training in developing countries in the Middle East and South Asia;
- Learning materials for schools in Southern Africa;
- e-learning for open and distance learning courses in the UK;
- Research on strategy and evaluation tools for e-learning, expert systems and knowledge management.

It shares with many others the frustration at systems that "do" e-learning, but for the most part do it only marginally differently from what we did 10 or 20 years ago using other quite adequate media, and in the process generating huge amounts of expensive digital traffic, data mountains/lakes/landfill sites, and Public Relations, but not much digital intelligence. I will try to tease out some lessons and issues on how we might do things differently if we started from different design parameters.

2. Distributed Learning

There is no doubt that digital or e-learning, or e-enabled learning has made a difference to our lives, and that it is largely based on digital information and communication technologies. However, as with all other innovations, ICT will go through cycles of development, hype, overshoot, disillusionment, shake out, and consolidated growth. We are probably currently at the disillusionment and shake out point, and will start to see more tentative, consolidated growth from now on.

But the crux of managing this turning point [for ICT like any other technology] is to realise that the key issues are not technical or technological. Once the "wow" factor has soured and faded, we need to focus on how we want to use it, sensibly, and why. There are some crosscutting trends that might point us in the right direction.

In overall terms, what has developed more than anything else is *distributed learning*. The fact that it is powerfully, cheaply, and easily (?) distributed through integrated digital media is important. But the levels of digital integration have only just started, and it is the *result* – distributed learning – rather than the *mechanism* – digitalisation, that we should focus on.

There is and will always be proprietary information and knowledge. But most of the old exclusion techniques and cycles are changing or fading: you can no longer be excluded by age – younger and younger people are getting hold of all the information they need and want, and quicker. Likewise distance, nationality, religion, wealth/parentage, "outlaw" status, libraries, academies, country, cost, sequence and ritual, and even access to technology are all being penetrated.

Learners are better sited and sighted – they are quite simply in a better position to see what is going on around them, interact with it and with people who are involved with it, and learn from that. They are also better "cited" as they can learn from and refer to a much wider range of people and texts, more quickly and effectively. Some of the ideas that I will use in writing this paper, for instance, I got from a casual reading of various Blogs/Klogs a few hours ago.

So what matters is that learning is distributed – the medium does not matter. The digital media are well established. We have arrived at quite a different media and communications platform – so we no longer need to be fascinated by the latest medium or gadget, and should get on with the job of using whatever we have – blended media and blended learning: blended-*distributed*-learning.

Following from this trend, i.e. comprehensively distributed learning, is the second trend, namely that not only is the *blend* important, but none of us are at the *point of control* – there is no single *point of control* – there are many, competing points at which learning and learning resources gets initiated, stimulated, certified, commodified, patented, copyrighted, shared illegally or legally, accredited, and all of them are changing.

Learning and learning resources are [and will increasingly be] distributed to an unprecedented extent. All bets on the old walls and fences around learning are off. This is, surely, positive. If so, we need to go with the flow, however much our institutional, personal, and patronage practices get disrupted. As I said above, there will always be proprietary and public learning resources and opportunities – and there will therefore always be business and work in enhancing learning. And conversely, there will always be interesting developments in sharing knowledge – developing the "new commons" of the knowledge society.

3. Just-in-Context Knowledge

Snowden (2002:3) citing Stacey (2001) talks of the paradoxical nature of knowledge, which is both a *thing* and a *flow* or a *process,* and he emphasises that we have to see it as *both* – not the one or the other. He also cites some key heuristics: "knowledge can only be volunteered" and "we only know what we know when we want to know it', and he emphasises the value of narrative.

Knowledge is thus embedded in relationships and context, and little of it is amenable to commodification and categorisation in a database, no matter how sophisticated. Most of it is situated in the spaces of the relationships between human beings. And narratives come back to take up their place alongside algorithms, just as they did in Athenian discourse.

This is similar to the notion that knowledge is essentially *strategic*, and information is essentially *procedural* (Williams 2001). Knowledge subsumes and includes content as well as complex procedural algorithms, but it is more akin to *intelligence* than information[1]. It operates within a context, and is implemented or used by particular people in particular positions and contexts. To paraphrase, knowledge is a synthesis of the *how* and the *why* things get done, whereas information stops at the *how.* Knowledge is paradoxically more contextualised, and therefore less abstract than information, even though it operates at a meta-information level.

Knowledge is embedded – it is what I would call "just-in-context". This means that it is specific to time, place, sequence and timing, and position and relationships – within discourse communities/communities of practice, and personal relationships of trust and confidence. *Your ability to exercise what you know is partly dependent on the fact that I know what you know, that you know that I know that, and that I trust you to use it appropriately.*

It follows that knowledge cannot be abstracted from context – physical or social. Snowden (op cit: p3) says that to manage knowledge "we need to focus more on context and narrative, than on content". In relation to e-learning, or distributed learning, what is important is that we don't restrict learning to abstracted procedural information, and call that knowledge. Learners need to develop their own knowledge, through a process of learning that will include procedural information, but which they must relate to various contexts – contexts in which it is generated, learnt, used, and in which they can use it. Algorithms can only be understood and used within narratives.

[1] The point becomes clear if we substitute "intelligence" for "knowledge" and ask ourselves what on earth "intelligence management" would be.

4. e-learning

Where have we got to in e-learning? There is undoubtedly much good and innovative practice. But there are also many cases in which only the technical transition has been made, and not much more. Lots of "e-learning" would more appropriately be called "e-copying/photostatting", "bookware", e-distribution, e-searching, and perhaps e-publishing. But this is not much more than increased efficiency on the supply side. It does not necessarily impact on effectiveness in satisfying learner demands, and in line with the trends in *down-loading* and externalising costs from the public sector to the public, it might even decrease effectiveness in some cases. Some members of the public can't afford the externalised costs, and are unimpressed that the internal "costs" have been reduced to help reduce taxes and fiscal deficits.

It is commonplace now that we are suffering from information overload, as well as email-induced communication and interaction overload. From a systems design point of view, we need to determine the *learning* parameters of digitising distributed learning. If the aim of learning is to explore your surroundings to accumulate useful knowledge, what is it that contributes to learning and knowledge – over and above faster copying, searching and distribution? This might be called e-linking, e-relationships and networks, and e-enhanced strategy.

5. Designing Distributed Learning

The basic design parameters are:

> Linking, analysing and synthesising at a conceptual level helps to facilitate learning, and to capture and manage the knowledge that results from learning. Relationships require interaction, including both intellectual and personal relationships. And strategy requires a synthesis of information about procedures and context, and the experience and knowledge against which to measure and evaluate them.

If we know that knowledge includes content, context, and relationships; that learning requires exploration, and links at the conceptual level, as well as personal and intellectual interaction, and the ability to manage information about procedures and contexts against the template of experience, then we have the beginnings of a framework for the design of distributed learning.

Exploring includes finding out what is out there just as much as putting out your "feelers" – physically and intellectually, to see what happens. So in a digitised world of distributed learning, we should use all the digital and analogue media, particularly as they become cheaper and more user friendly – email, websites, weblogs, digital video and webcams, digital photography, and so on.

Links at the conceptual level need to be more than just linear-embedded "threads", elegantly "woven" by e-moderators. However interactive these are, and they do enable valuable virtual communities or virtual "classes" to flourish, they are no more than *stacked lists,* or what I call "stringed-bead discourse" – a number of "beads", each one of which is only linked to the one before and after it, with little or no relation to any of the other "beads", apart from some social and stylistic "aesthetics". The same applies to the electronic "filing systems" that are available in word-processing packages (albeit with some primitive hyperlinks available).

What is needed is more than a linear architecture – and there are two-dimensional graphic options in some of the e-mind-map packages available, but these are hardly mainstream in VLEs.

What is needed is a two-dimensional plane on which learners and teachers can explore, elaborate, rearrange and restructure, link and question, the relations between concepts and contexts, with dynamic granularity and navigation [which just means that you need to be able to navigate "free-hand" and zoom in on any point of the plane just as you would when using a digital photography cropping facility]. A facility to establish icons alongside and/or related to objects on this plane is also needed. Behind this (in XML format) there needs to be a data base, linked to the metadata on this plane. And this needs to be available in a collaborative workspace format.

This could be developed further, based on some of the available software. It would start to deliver some of the dynamic metadata links that are the basis for any non-digital, non-technical learning and knowledge, in those rather sophisticated "neural network processors" called humans.

5.1 Just-in-Time Informal-Formal Knowledge

Snowden (op cit) outlines a framework for facilitating just-in-time knowledge. His paper is very useful, as he details a framework for analysing four domains of knowledge, each with different management implications, and then relates just-in-time transfer to those domains. I wont repeat the details – they are quite extensive, and there is no need to try to summarise them here.

5.2 Decision Making

Given that the aim of learning is useful knowledge, two things are necessary for learners to manage their own knowledge as they learn. They need to be able to capture and manipulate the links that constitute learning and knowledge on an appropriate high granularity graphics package. Second, they need to be able to capture the knowledge, and access it efficiently, for use. Which means they need to be able to search through the information available quickly and effectively.

That in turn means that the knowledge that is commonly held should reflect the decision-making processes that someone *using* that information and knowledge would follow. Given that the conceptual map is metadata, it would not inherently be a problem for there to be a variety of different maps, each for a different type of user. The users in turn could customise their maps, and the links from them to the database, in line with the specifics of their context, as they change from time to time. So the software would be required to include the necessary dynamic editing facilities.

6. Sharing Knowledge

I said, above, that there will always be proprietary and public learning resources and opportunities – and there will therefore always be business and work in enhancing learning. And conversely, there will always be interesting developments in sharing knowledge – developing the "new commons" of the knowledge society.

One of the paradoxes in distributed learning is that we expect people working in this sector (certainly the public sector part of it) to share learning resources within a competitive and increasingly commercialised market, in which their own jobs and livelihoods are neither protected nor guaranteed.

If it is true that distributed learning no longer has a single point of control, and that distributed learning increasingly occurs between a myriad of different points – some human and some digital – then it would make sense to optimise the potential for sharing information and knowledge, if possible.

Most commentators (see David Gurteen's website for examples) seem to agree these days that only "a limited amount of knowledge can be fully separated from its owners and transferred to the best practices domain" (Snowden op cit p13). And the increasingly "marketised" and commodified environment would not seem to make sharing possible.

Both teachers and learners face a paradox: how can they be expected to share information and resources in a competitive, commercial market? Action research in designing and implementing a knowledge base for vocational training for the community sector in the Middle East has started to put a working model together. This knowledge base design could be used to solve this paradox, and as the basis for national and international networking and sharing in schools and in the vocational training and community sectors.

Schools and community sector programmes are expected to "share resources for the common good". But they are also expected to maintain their own (competitive, dare one say it?) value added, and they have to keep an eye on their own careers, in a job market where there are few certainties and even fewer guarantees. Researchers based in Reading (Williams and Carmichael) worked with a training centre in the Middle East to identify their training and learning problems, and then to design and implement the software for a knowledge base appropriate to their needs.

6.1 The training centre wanted to:

- Use the vast amount of learning material available internationally, but adapt it to local context and requirements.
- Share resources as far as possible, but maintain a competitive advantage.
- Add to available resources, and expand its business, while sharing (both ways) with outsourced trainers and external institutions.
- Build up a resource which could be used for specific, narrowly defined training requirements, but could also be used flexibly for different needs, clients, and contexts without starting from scratch each time. The output

also needed to be available in Arabic and English texts and scripts, and displayed in various formats.
- Enable trainers and training managers to explore and learn from related research, evaluation, theory, and other institutions.

6.2 Stages in the process:

- The core users were narrowly defined: as trainers and training managers (and less so, administrators). The elements of the system had to be checked to see if they would fit into the organisation's workflow on a daily basis.
- The key training and learning elements had to be defined, and if possible separated into different layers of resources, that could be combined, revised, and added to, in separate operations. These were "learning objects" such as pictures, texts, graphics, exercises etc, "lesson plans" which combine learning objects, and "courses" which combine lesson plans. Lesson plans have related "learning outcomes" and assessment frameworks linked to them.
- The outputs needed to be defined, and the software mechanisms created to link the resources into lessons and courses, and provide the outputs.
- Further links need to be put in place to related research, theory, evaluation, and institutions and people.

6.3 Findings

- Consistent institutional backing and commitment is critical to success or failure.
- Open source software development can provide the flexibility to combine languages, scripts, and learning objects and lesson plans, effectively, without the expense and rigidity of proprietary packages.
- Most of the "learning objects" can be shared in the pubic domain.
- Most of the "lesson plans" that use these learning objects can be kept in the private/competitive domain where necessary. This distinction between mostly public domain learning objects, and mostly private domain lesson plans and courses enables substantial sharing, and flexible "tagging" of resources to indicate how and where they may or may not be shared.
- Substantially increased flexibility can be achieved in combining elements in the resource base and "tagging" them if XML (rather than HTML) is used – and this does not affect the ability to access the resources via any Internet browser.

7. Conclusion

I have sketched some of the basic elements of a framework for an integrated approach to the design of distributed learning and just-in-context knowledge management. The learning and knowledge issues have, hopefully, been separated out from the technical issues and the technology, and then reinserted into a debate about how the *learning* design parameters could be realised and developed with current capability, and how the potential for distributed learning to benefit from shared resources could be managed within an increasingly commodified world.

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