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# **Teaching at a Distance: Building a Virtual Learning Environment**

**Maria Lee Randall Thompson  
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The JISC Technology Applications Programme is an initiative of the Joint Information Systems Committee of the Higher Education Funding Councils.

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We are happy to discuss our experiences and to assist anyone wishing to develop their own Virtual Learning Environment.

*Any comments on this report will be gratefully received*

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### **Overview of Report**

In 1995, The Queen's University of Belfast set up the Outreach Initiative, which aimed to encourage academic staff at Queen's to offer their taught courses to students across Northern Ireland. The first stage of this initiative was to create a remote campus in Armagh. As part of this initiative, the Centre for Computer Based Learning (CBL) was asked to deliver its MSc in Computer Based Learning (MSc), initially to one site and then to a number of remote sites. The purpose of this was to:

1. explore the potential of using Information and Communication Technology (ICT) to teach at a distance.
2. identify the issues that must be dealt with in order to deliver effective and efficient virtual courses.

This report describes the developments associated with delivering the MSc at a distance and will:

1. explore the issues involved in building and supporting effective Virtual Learning Environments (VLEs), in particular looking at the role of central support agencies, such as computing service departments.
2. explore the key pedagogic and technical elements, which make the VLE experience successful for staff and students.
3. highlight how these elements may be applied to courses at other institutions.

Although some of the technologies and approaches described in the early years may seem a little dated, they do help to bring out the evolution of the basic issues and innovations associated with supporting virtual learning. We believe that anyone moving from a traditional single-site course to multi-site teaching will find that they will work through similar issues.

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## INTRODUCTION

### CONTEXT

#### The Outreach Initiative

In 1995, The Queen's University of Belfast established its Outreach initiative. This initiative aims to provide wider access to higher education by offering a more flexible form of provision on a 'closer to home' and indeed 'closer to work' basis. This is being achieved by the creation of outreach centres, phased over a number of years, throughout Northern Ireland. These campuses will use video-conferencing and data-conferencing technologies to facilitate course delivery. It is intended to target not only school leavers, but mature students from the local population who, for one reason or another, have been unable to contemplate a place at University. This includes: well qualified school leavers who in the past have been constrained by their distance from university; adult learners who wish to move on to degree level; members of the community who wish to improve their employability and marketable skills; people in mid-career who wish to extend their current qualifications, and those who wish to return to learning at this level because of their interest in an academic subject or discipline.

Queen's Outreach initiative is being implemented in several phases.

In its first year, academic year 1995-1996, a remote campus was established in Armagh, and one course was delivered at a distance.

In 1996-1997, links with Omagh College of Further Education were developed to offer an Outreach node in Omagh.

In 1998-1999, as a result of developing the School of



Figure 1: Map of Northern Ireland

#### MSc in Computer Based Learning (CBL)

The MSc in CBL (MSc) was established in 1994. The course aims to provide students with the knowledge and skills required to develop and integrate computer based learning (CBL) materials into teaching and learning. The course combines the theoretical concepts underpinning CBL development with practical experience of designing and developing a range of CBL materials. The course comprises:

- an induction course; this aims to induct the students in the basic skills in information and communication technology required for the course.

- 
- 6 modules; Information Technology and Services, CBL Approaches, Multimedia Authoring, Courseware Engineering, Multimedia Programming, Authoring for the World Wide Web.
  - a project culminating in a dissertation.

The approach to student learning is based on the premise that learning is an active process - students learn by doing. Consequently, in addition to traditional lectures, the course aims to provide the students with opportunities to develop a range of skills (both intellectual and practical) through computer practical classes, group work, tutorials and case studies. Assessment is continuous and comprises exercises, main assignments for each of the six modules and the dissertation.

The MSc course may be taken on a full-time or a part-time basis. The full-time students complete the course in one year and, generally, are based at the main site in Belfast. The part-time students complete the course over two years. These students are based at one of the three sites: Belfast (main campus), Armagh (University Outreach Centre) and Omagh (Omagh College of Further Education). The course started with thirteen students but currently has sixty-eight students, twenty-one of which are based at remote sites.

### **Students on the MSc in CBL**

The course is open to anyone with an honours degree or equivalent qualification, or alternatively a degree or equivalent qualification with suitable experience in education, training, or information and communications technology. The students come from a variety of academic backgrounds including Information Management, Psychology, Art and Design, Education, English and Geography. Many of the part-time students teach or lecture, some are Education and Library Board Advisory Officers and others work in the software/computing business.

The students are not required to be computer literate but obviously, as they have applied to do the course, they have an interest in the use of technology in education and training.

### **AIMS AND OBJECTIVES OF THE REPORT**

In 1995, the Centre for Computer Based Learning (CCBL) was asked to explore the potential of using Information and Communication Technology (ICT) to deliver the MSc in CBL, initially to one site and then to a number of remote sites. More importantly perhaps, it was felt that this course could be used to identify the issues that must be addressed in order to deliver virtual courses effectively and efficiently.

Using the MSc in CBL as a case study, this report aims to

- explore the issues involved in building and supporting an effective Virtual Learning Environment (VLE). The lecturer's perspective of this process is presented in the chapter *The Pedagogic View* and the technical perspective is presented in the chapter *Technical Support View*.
- explore the key pedagogic (*The Pedagogic View*) and technical elements (*Technical Support View*) which make the VLE experience successful for staff and students.

- 
- highlight how these elements may be applied to courses at other institutions. The pedagogic element is presented in the chapter *The Pedagogic View* and the technical element is presented in the chapter *Technical Support View*.

Terms underlined in the text of the report are elaborated in the glossary in Appendix 1.

This report is targeted at academics involved in, or considering the adoption of network learning and support staff who are involved in, or considering the provision of support to distance learners.

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## THE PEDAGOGIC VIEW

### INTRODUCTION

This chapter describes the development of the VLE from the lecturing staff's perspective. It will outline the process of preparing for the VLE, and describe and review the delivery of teaching within the VLE.

### PREPARING FOR THE VIRTUAL LEARNING ENVIRONMENT

Although the MSc lecturing staff had agreed to deliver the course to remote sites, a number of concerns emerged regarding the impact, on both students and staff, of moving to virtual learning. The main concerns can be categorised as follows:

*Equity*; how could staff ensure that students at the remote sites would not be treated as second class citizens or special cases?

*Participation*; how would the students at the remote sites be able to participate effectively in the course, i.e. would they be able to contribute and interact with the staff and other students?

*Teaching*; would the introduction of a distance factor compromise the teaching and learning approaches used throughout the course?

*Workloads*; would additional work and resources be required?

After much discussion, the lecturing staff agreed that any solution needed to:

*keep sight of the importance of lecturer-student and student-student interaction in the class*; social communication was seen as an essential component of learning. Bringing the students physically together provides them with an opportunity to form learning communities that can be both educationally and personally enriching. Interaction with other students can help to motivate the students to persevere by providing structure and psychological support.

*avoid transferring any additional cost to students*; the solution identified had to be accessible to the students at an acceptable cost as one of the main aims of the Outreach Initiative was to open up higher education to people across Northern Ireland and from all sectors of the community.

*focus on the educational needs and not the technology*; Rowntree (1992) warns "the chief mistake people can make is to decide on the medium before they have thought of the message". It was clear that the lecturing staff needed to identify how they wanted to teach before selecting the technologies.

### Identifying the pedagogical requirements

A teaching and learning needs analysis was carried out amongst the course lecturers. This had some initial difficulties. The issue of what the lecturers wanted to do was rather clouded by what the technical solutions could offer. Staff were heard to comment "*How*

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*can I tell you what I need, when I don't know what the technology will enable me to do?"* To overcome this, staff were encouraged to focus on how they currently teach and how they wanted to teach in the coming year - video-conferencing or not. Once the teaching approaches were identified and analysed, it would be possible to investigate ways in which the technology could meet the teaching and learning needs.

After much discussion, an outline of the teaching and learning activity emerged. Students spent up to three hours a week per module in a face to face situation. This comprised time spent attending lectures, practicals and tutorials. They were also expected to spend eight to ten hours, per module per week, on independent study, e.g. reading, assignments, exercises, etc. The staff were happy with this approach and were keen to maintain it. They also identified common teaching methods they currently used and wanted to be able to use in the VLE. These are described in Appendix 2.

### **Becoming familiar with the technology**

Once the staff had agreed what methods they wanted to use in the VLE, it was then time to explore what technology was available and what it could offer. This step is important if lecturing staff are to contribute to the discussion and decisions regarding what technology to adopt. Demonstrations of video-conferencing and data-conferencing technologies were organised to introduce how these technologies could be used to support distance teaching and learning. This was followed by a 'hands-on' session with the technology in which the staff explored how they could use the technology to support their teaching.

### **JOINT DEVELOPMENT OF THE VIRTUAL LEARNING ENVIRONMENT**

Based on the analysis of the teaching and learning approaches and the technologies, a specification of the teaching and learning needs was drawn up and this formed the basis for the development of the VLE. The design of the VLE was a joint venture between lecturing and technical support staff. The course would be supported by the adoption of a range of technologies that would provide a richer means of communication than any one technology alone. These technologies would support interaction with:

- tutors and the students in real-time using video-conferencing and data-conferencing, and asynchronously using email.
- students and resources, electronically through access to both the CCBL server and the course web server, and paper-based through the resource centre at each site.

The technologies selected were based on what the students would have easy access to, the appropriateness of the technology for the course aims, the potential to provide an interactive virtual class environment, and cost! A detailed outline of the technical solution is provided in the chapter, "*The Technical Support View*"

### **IMPLEMENTING THE VIRTUAL LEARNING ENVIRONMENT**

The implementation of a VLE is often viewed in terms of the technology, but there is a range of human and organisational issues that the lecturing staff must also address. For the staff involved in the MSc, these included:

- 
- staff training and support
  - student support
  - course organisation and management

These issues will be common to any course delivered at a distance and were identified by several of the sites we talked to during the production of this report.

### **Staff training and support**

Although computer based support technologies are an important factor when delivering teaching at a distance, the success of the teaching lies with the ability of the lecturer to communicate with, and motivate their students. Training and support were key factors in helping staff to develop the skills and confidence to deliver teaching using the technology, particularly video and data-conferencing. The training was broken into three key stages:

1. *Orientation Stage*; all VLE facilities were demonstrated to the staff, who were then given an opportunity to familiarise themselves with the systems.
2. *Contextualization Stage*; staff were invited to demonstrate examples of their teaching approaches using the systems. Technical and lecturing staff were able to share ideas on how to teach using these systems.
3. *Implementation Stage*; all staff were given a high level of support when starting to teach to remote sites. At the start of each module, a second person attended the classes to offer support. The support was withdrawn only when each lecturer felt confident that they could cope on their own.

The *Contextualization Stage* was arguably the most critical and sensitive component of the training process. The experience of the staff on the MSc and many of those we talked to at other universities suggests that training should:

- be provided as early as possible to enable lecturers to consider the strengths and weaknesses of the technology when planning or modifying their courses.
- ensure that lecturers get ample opportunity to contextualise the learning i.e. apply the lessons learned to their own teaching situation.

User support should also be given serious consideration when preparing for virtual teaching. The nature of this support will depend on the particular lecturer(s) and the technology to be used.

By the end of the training programme, many of the staff's apprehensions had disappeared and they had begun to feel more confident that they would be able to utilise these technologies to support their teaching.

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## Student Support

The decision to teach at a distance required consideration of the support facilities available for students at the remote sites. Issues that emerged included:

- Learning through the new technologies
- Coping with technology related problems
- Submitting and receiving assignments and other materials
- Sorting out misunderstandings with the course content
- Providing pastoral support, e.g. helping students to cope with the stress of balancing demands of both work and study
- Providing students with access to other university services

Ways of supporting students included:

*Training;* it was decided that it was necessary to give the students some time and opportunity to acclimatise to the new environment. This was achieved through an expansion to an existing ICT student induction course. Students at the remote sites were provided with a short introduction to the equipment and its functionality. In addition, an initial face to face meeting was arranged between the staff and the students. Together these steps helped the students to become familiar with both the lecturing staff and their VLE.

*Other students;* bringing students together on a weekly basis would help to develop relationships and provide the students with an opportunity to develop peer support.

*Tutors;* students would be able to contact the staff directly via email and telephone. In addition, a member of staff at the Outreach Centre was nominated as a Student Support Officer.

*Other services;* library and technical support would be provided at each centre. In addition, most of the main services e.g. Careers, Library, Computing Services had web pages with information and resources which would provide general guidelines and resources for students. These services could be contacted by email.

*Access to resources;* all resources were virtual i.e. available on the web or central server, or localised i.e. placed at the local centres. The library budget was increased to provide a range of core books, for the course, at the remote site. Students would also have access to the library catalogue and could request additional books or journal articles from the main library. This is a slower process than would be experienced by students on the main campus and so must be planned carefully. At each centre, students would be provided with access to computers, printers, audio-visual equipment and general learning resources, e.g. CD-ROMs.

*Delivering and receiving material;* arrangements were agreed with the administration staff at the Outreach centres to collect and distribute material to the students. Material such as handouts to support the modules and assignments could be posted, faxed or emailed to the centres.

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## Course organisation and management

A number of issues arose regarding the organisation and management of the course, including the following:

- Student application and enrolment i.e. who does it and where?
- Time-tabling
- Contingency Planning

*Student application and enrolment;* it was agreed that student application and enrolment would be conducted by the staff on the main site. All course enquires would be directed to the appropriate MSc staff. The Student Admissions Office and then the CCBL would deal with all applications, as per students applying to the main campus. In the first year, the students would have to enrol at the main site in Belfast, but it was planned that the students would eventually be able to register for the course at the appropriate remote site.

*Timetabling;* as course delivery required video and data-conferencing software at each site, it was important to ensure that appropriate rooms were available at the required times. This had to be done early enough to ensure access to the appropriate rooms.

*Contingency planning;* contingency arrangements are an essential aspect of effective virtual course delivery. It was decided that all presentation slides, lecture notes, lecturer annotations and lab class material would be available at each remote site. Each site would have a copy of the running order for the session. If any part of the technology failed to operate properly then students would be expected to work their way through the session resources. When the systems were fully operational again, the lecturer would endeavour to deal with any resulting issues.

## THE VIRTUAL LEARNING ENVIRONMENT

Once the training was completed, and decisions had been made regarding support for the students at the remote site, the way in which the technology would be used to support the pedagogical requirements was finalised. Table 1 outlines how the technology was matched to the pedagogical requirements.

<b>Approach</b>	<b>Technology adopted</b>	<b>Description of the approach</b>
<b>Lectures</b>	Video-conferencing with data-conferencing.	Lectures would be delivered using a combination of video-conferencing and data-conferencing. Data-conferencing would be used to present slides/overheads (using MS PowerPoint) and to demonstrate CBL software or programming techniques. Students would be able to interact by asking questions, and the lecturer could ask questions or sets activities for the students.
<b>Practicals</b>	Video-conferencing with data-conferencing.	Students at all sites would work their way through a paper-based practical, on the computer.  A tutor would provide support for the students at the remote site through data and video-conferencing. Students could request help at any point. Viewing the student's work would require the student to share their work with the tutor using the data-conferencing software.
<b>Group work</b>	Video-conferencing or a hands-free telephone, perhaps with data-conferencing.	Group work could be organised either on or cross campus. Cross campus group work would involve video-conferencing (or a hands free telephone could be used). Depending on the nature of the group work, the students could also use data-conferencing to collaboratively work on a document or diagrams, etc.
<b>Project supervision</b>	Email, telephone, post, data-conferencing and video-conferencing.	Students could use email and the telephone to contact their supervisor and discuss their project. During the project, they could use email to keep in touch and send and receive material. Video-conferencing or telephone and data-conferencing could also be used to discuss software prototypes.
<b>Tutor support</b>	Email, telephone, post, data and video-conferencing.	All students would be encouraged to email staff if they have a query or wish to make an appointment. Staff could also be contacted by telephone. Video and data-conferencing could also be used if a student wished to discuss some work in progress.

<b>Resources</b>	<p>Paper-based material and software available in the library at the resource centre.</p> <p>Electronic material available on the CCBL server and course web server</p>	<p>A range of resources would be available to support the students' study.</p> <p>Each module would be provided with a 'work space' on the CCBL central server to enable access to course materials such as lecture notes, software, CBL exemplars, etc. Students would also have access to books, journals and off-prints in the library. Each student would have their own 'personal space' on the CCBL central server to both store and submit work for assessment.</p> <p>The course would have a web page to provide details about the course, the modules, etc., and have access to general resources, e.g. news, schedules, study guidelines. Each module would have its own web page to provide resources for lectures, group work and practicals.</p>
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**Table 1: Outline of teaching approaches in VLE**

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## TEACHING IN A VIRTUAL LEARNING ENVIRONMENT - AN EVALUATION

The role of on-going monitoring and evaluation of the VLE is of vital importance to its development and evolution. Feedback can be provided by:

- staff involved in delivering the course
- students
- technical staff supporting the course

Evaluation should be holistic, identifying the impact of the VLE from a range of views, such as:

*Human*; the impact on the students and staff, and their relationships.

*Organisational*; the impact on the course organisation and management.

*Pedagogical*; the impact of the technology on the teaching and learning.

*Technical*; identifying any technical problems.

Within each of these categories, we can identify issues for the lecturing staff, students and technical support staff. This section discusses the main issues that have emerged from the experience and evaluation of this course, and from discussion with others involved in similar activities at other universities.

### Introduction

Generally, the experience has been positive. The lecturers report that they have not re-designed their approach to teaching and that the principles of good practice that apply to the design and delivery of teaching in a traditional setting apply also to teaching in a VLE. The students' performance on the course is comparable across the three sites. There has been a low drop out rate on the course; those who have left have done so primarily for family or work reasons. However, there are a number of factors that must be considered:

### Human

#### **Greater discipline in communication is required**

The use of video-conferencing does demand a greater discipline in communication. Lecturers need to project themselves more and aim to create a dynamic presence. Depending on the system, excessive movement can cause a distortion of the image, resulting in restrictions on movement. The teaching staff have found it necessary to adapt their presentation style. There is a range of guidelines available to help improve the delivery (see for example the SIMA reports). It is worth noting that many of these guidelines are also applicable in a traditional face to face situation - in fact many are based on good practice underpinning traditional face to face teaching.

#### **Teaching involves more than the lecturer**

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In traditional teaching, most lecturers work with materials without the need for technical assistance. Once a course includes a major technology based component, there is frequently a need for support staff to provide help with the setting up of the system. The more complex the media, the more control that may need to be surrendered, at least initially.

It is vital for the smooth running of a course that a good working relationship is established between the lecturing and technical staff and that both groups treat each other with professionalism and respect. Lecturers need to ensure that support staff have clear details of requirements in good time and support staff need to ensure that the technology is operational in good time.

### **Technology impacts on all the students**

Every effort has been made to ensure that the technology being used to support the course is effective and efficient. However, the student evaluations reveal that a small number of the students on the main site find it disruptive and would prefer a one-site approach (Lee, in preparation). Despite the technical difficulties, the students based at the remote sites prefer to attend the Outreach centres rather than travelling to the main campus. They also value the interaction and support of their fellow students at the remote site and will often stay on after class to discuss issues further (Cole, Armitage 1996). The distinguishing factor here is one of need – the need for a postgraduate qualification so close to home/work means that the students at the remote sites are more likely to embrace the use of the technology than those who have close access to the University. It is important, however, that lecturers realise that a VLE impacts on the students at all sites. It is therefore important to consider the needs of students at the main campus site when moving towards a VLE.

### **Teaching and learning by video-conferencing can be more demanding**

Many lecturers report that video-conferencing requires more energy than traditional teaching. They identify number of reasons for this:

1. The lecturer must concentrate simultaneously on the content, the visual material and the students on both the main and the remote sites. This may be more demanding and could lead to a higher level of stress and a feeling of exhaustion afterwards. The experience of the staff on the MSc is, however, that this lessens with experience.
2. The VLE requires the lecturer and students to be more proactive. In a traditional class, tutorial or practical, a lecturer can learn much from students' non-verbal behaviour. A puzzled look from students often suggests a lack of understanding without the student having to ask a question. This is much harder when teaching in a VLE. For example, in a computer practical class, when dealing with the remote site, there is not the same opportunity to 'look over a student's shoulder' to see how they are progressing. Using the data-conferencing software, the lecturer can link to any of the machines that the students may work on and discuss their work with them. However, this approach is more dependent on the student requesting help than in a traditional practical where it is easier to spot a request for help or a puzzled look. In addition, the tutor has to be more proactive in checking that the students are coping, particularly in the early stages.

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## Organisational

### **Greater planning and preparation is required.**

The literature suggests that the preparation for video-conferencing comprises; producing visual aids and planning the format of the session (Mason 1994 , Jacobs et al 1997). The staff on the MSc report that greater planning and time is required for the latter than the former. It is necessary to plan the delivery more carefully; an impromptu discussion or illustration of a point on a flip chart is more difficult to accommodate. Material that is intended for the students must be sent several days in advance of the class or put on the web, which takes times and requires more organisation, at least initially.

The lecturers on the MSc had already been using computers to present their overheads and demonstrate software. So for them, combining data-conferencing with video-conferencing and using a presentation tool such as MS PowerPoint requires no more preparation of visual aids than would be required for a traditional setting.

### **Technology can support more than teaching**

Although the technologies were selected with teaching and learning in mind, they can support a number of non-teaching activities effectively and efficiently. Over the last few years, the use of the technology on the MSc has expanded to support a range of activities, including:

- Each module is evaluated using web based evaluation forms. These forms are analysed and the sent to the appropriate lecturer.
- Joint Consultative Committee meetings are carried out by email and video-conferencing.
- Some meetings with the external examiner are conducted using data and video-conferencing technologies.

These uses have provided real savings for the staff involved in terms of time and travel.

## Pedagogy

### **Managing interactivity is challenging**

There are particular challenges in managing interactivity when students are at a distance (Collis 1996). On the MSc, interactivity emerges as an issue in both class discussions and cross campus group work.

*Class discussions* have been somewhat limited in the VLE. In order to achieve a satisfactory discussion, several microphones well placed around the room are necessary. It is possible to conduct a discussion by passing the microphone around the lecture theatre to the questioner. However, the discussion can become very instructor directed with questions and responses directed and delivered through the lecturer. The difficulty in providing adequate microphone support is not to be underestimated – satisfactory audio support is both expensive and difficult to provide; there are problems with echo, fluctuations in volume and sometimes a brief loss of sound.

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Increasing class numbers have had a greater impact on class discussions than might be expected in a traditional classroom. While it is possible to conduct a discussion with a class of forty students in a traditional classroom, when the class is distributed across three sites, it becomes more difficult.

*Cross campus group work* employs video-conferencing and sometimes data-conferencing. The number of cross campus groups is limited by the number of video-conference systems available. The majority of the students involved in these groups have found it useful and have requested more opportunities for cross campus work. They appear to interact with each other in a natural and spontaneous manner. A small number of students have expressed frustration, particularly when using data-conferencing software, feeling that the time expended is not justified by the learning achieved. However, it is important to acknowledge that this may have more to do with the group's approach to the task than the use of the technology.

Nonetheless, it does require more time and effort from the students to complete the task set, in comparison to campus based groups. They need extra time to become comfortable with the system, particularly at the beginning. Consequently, although the lecturers are keen to encourage cross campus groups (see section *Isolation can lead to uncertainty in standards*), it is not recommended when the group work is being assessed.

### **Use of a range of technologies**

No one technology can support all types of teaching and learning - the most effective approach is to combine a range of technologies. On the MSc, technology supports the teaching and learning on the course as follows:

*Video-conferencing*; Lecturing with video-conferencing seems to approximate the quality of interaction available with a traditional lecture. Although, there are some restrictions on interaction, it is also possible to support discussion; students can engage in two-way conversations and those who don't contribute can 'eavesdrop' and thus gain benefits from observing the discussion.

It is not always essential to use video-conferencing; for some activities e.g. practicals, it is conceivable that audio combined with the data-conferencing could be adopted. However, as video-conferencing supports real-time visual interaction, it makes the communication much easier. For the learners, there is a level of comfort in the visual contact; a visual presence of others appears to enhance a strong sense of social presence.

*Discussion lists*; more recently, on-line discussion lists have been included to provide an alternative and flexible means of bringing students together. Communication by text is delayed i.e. students can contribute in their own time, and tends to be more reflective. However, its implementation has been problematic on two levels

1. it is perceived by students as being artificial, given that they see each other regularly.
2. it is hard to motivate students without home based personal computers to use computer conferencing. Unless they live quite close to the Outreach centres, they are unwilling to go there for communication except on the nights they attend class.

The lecturing staff are keen to develop the use of this technology but realise that successful use of discussion lists will require changes to the way the course is organised and taught.

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*Data-conferencing*; is essential in supporting computer practicals and the supervision of development projects. The ability of the student to share their work means that the lecturer can provide effective and immediate support and feedback. The technology also enables students to work collaboratively across sites.

*Email and web*; The addition of email and the web has enabled the staff to provide a range of support and resources that has benefited both the remote site and main site students, particularly the part-time students (see section *Supporting students at a distance needs careful consideration*).

### **Management of students at a distance can be difficult**

The issue of management or control will vary from lecturer to lecturer but a number of lecturers report that it is harder to monitor what the remote students are doing. It is easier for them to talk amongst themselves, to leave the room, interrupt the class etc. Freeman (1998) refers to this problem when video-conferencing to large lecture groups but it is also prevalent amongst smaller groups. It is more difficult to organise the students to work in independent groups at a distance. The lack of presence makes it harder for the lecturer to assert their wishes. It is also difficult for the remote site students to monitor what the lecturer is doing in some contexts, e.g. group work.

There is therefore more onus on the lecturer to move between groups and sites in order to ensure that no one site feels neglected. The lecturer should also provide clear guidelines regarding the task set eg what exactly the students have to do, what length of time is required for a task, etc.

### **Supporting students at a distance needs careful consideration**

Although a number of ways of supporting students had been identified, the key issues are:

*training*; both staff and students on the MSc point to the importance of providing initial ICT training for the students. Both groups feel that this is essential if the students are to gain maximum benefit from the VLE. Not everyone agrees with this. One of the lecturers we talked to, in the production of this report, felt that the students on their course would resent the time given to training activities. The need for training depends very much on the existing skills of the students and what will be expected of them during the course.

*meeting staff and students*; both the staff and students believe that it is important for the staff to travel to meet with the students, ideally before the course begins and periodically throughout the course. This undoubtedly helps to establish and develop a relationship with the students. However, as a lecturer at one of the universities pointed out, this is not always possible or practical if the students are very far away and widely dispersed.

*contact with tutors*; it is important to provide the students with a number of ways of contacting staff. On the MSc, email and telephone are the main forms of providing support outside of class time.

Telephone consultations offer the possibility of ‘rapid turn-taking’ in a discussion. This is of great benefit when, for example, a supervisor is trying to refine their understanding of the student’s project. This is particularly important at the beginning of a project. Then, after the initial contact, where possible, communication tends to be by email. Students can send queries or attach drafts. Work is returned by email with comments; the revision

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facilities of MS Word have helped to communicate comments with greater ease for both the student and the supervisor.

Contacting a student at a distance is easiest when students have computers at home with an internet connection. Support is more likely to be asynchronous, i.e. via email, and so does not require simultaneous interaction. Students, who depend on the Outreach centres for email, tend to use the telephone and post more. This leads to slower response and difficulties in scheduling time.

### **Students need encouragement and guidance in the use of the technology**

Over the years, staff have realised that, in addition to the training provided, students will need encouragement initially to appreciate the ease and flexibility that the technology can offer. To encourage the use of the technologies, particularly email, staff have adopted a number of methods, including:

- requiring the students to email short messages in the first few weeks related to work they are doing individually and in class.
- using email to send messages to the students regarding course details, information etc. and thus requiring students to check their email regularly.

The key to encouraging the students to use any of the technologies, but in particular the data-conferencing during class practicals, is the speed at which staff respond to a student's problem. If the tutor responds quickly using the software and helps the student deal with their problem, then the student is more likely to ask for help at a later point.

It is important however that the role of email is clearly explained to the students. Typically the staff will acknowledge receipt of a query within the day and then attempt to respond to the query within a reasonable time. It is important for the students to understand that just because a lecturer has email, they do not deal with it all the time.

### **Isolation can lead to uncertainty in standards**

In the first few months of the course being delivered in the VLE, the output of group work at the remote sites was of a lower standard to that of the groups on the main campus. The lecturing staff felt that it was likely that the students were uncertain about the standards they should be aiming for and that this uncertainty was magnified by their isolation from the larger student group. Such a small group was not exposed to the work of a range of groups. This is more easily achieved amongst the students attending the main campus as they are the larger group, they see each other more frequently and they get the opportunity to move between various groups.

To overcome this isolation, a number of strategies have been adopted, including cross campus group work, reporting of group work either on the web or through the on-line discussion list, presentation of student work, and the provision of exemplars.

## **Technical**

### **Good quality video is not vital**

The MSc course uses ISDN2, which presents poor quality video; the picture can be described as grainy and there is a lack of perfect synchronisation of the sound with the

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movement of a speaker's lips. This does not appear to impact on the students. Although they are aware of it at the beginning, it seems to be disregarded over time, for both staff and students, as they become familiar with it. Many of those we talked to report more or less the same effect.

### **Contingency plans are vital**

Technical problems do occur. A backup plan and support team is vital to cope with these problems. In addition, the availability of a hands free telephone is useful in the classroom when there are problems. Not only is it used to solve technical problems between sites, but it also offers a fallback option for completing a session.

## **CONCLUSION**

The MSc in CBL has been delivered as a virtual course, since 1995. The experience gained in that time leads us to believe that the success of virtual teaching and learning is dependent on a careful consideration of, and planning for, the impact of virtual teaching on all aspects of course preparation, delivery and management. This includes:

- careful consideration of the teaching and learning needs
- the appropriate selection of technologies to support these needs
- providing appropriate training and support for staff and students, and
- continuous evaluation of the VLE

There are many technologies to choose from and a wide range of combinations is possible which, if used appropriately, can successfully support teaching and learning in a VLE.

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## TECHNICAL SUPPORT VIEW

### INTRODUCTION

The purpose of this chapter is to offer a technical perspective of the issues associated with supporting the MSc in CBL. Although some of the technologies and approaches described in the early years may seem a little dated, they do help to bring out the evolution of the basic issues and innovations associated with supporting distance learning courses. Anyone moving from a traditional single-site course to multi-site teaching will find that they will work through similar issues, and may well find some of the innovations of use.

### THE TECHNICAL SUPPORT TEAM

A Technical Support Team (TST) which comprised lecturing staff from the course and technical support staff from Computing Services and Audio Visual Services, was established to support the course.

The TST's remit was to ensure that by the start of academic year 1995/96, a technical infrastructure and support environment was in place to facilitate delivery of the MSc to Queen's main site and to the remote site based in Armagh. The Team was also asked to ensure that all lecturing staff were confident using any associated new technology.

The composition of the team was judged to be important. The delivery of teaching to remote sites is dependent upon communication mediated by technology and therefore necessitates an appreciation for technological capabilities while balancing educational needs. To achieve this balance a number of people with differing roles and backgrounds need to work together to design and support the learning environments.

Therefore, the TST not only comprised the technical expertise required to support the project but also included experienced lecturers and trainers who could input to the pedagogic aspects of creating and supporting a VLE. This proved to be a key feature of the group. Over the years, it has become clear to the team that the technical and pedagogic design must go hand in hand. Many of the universities visited, in the production of this report, seemed to adopt a similar model; ensuring the technologists and the pedagogues work together when integrating new technology in teaching and learning.

### SPECIFICATION OF A VIRTUAL LEARNING ENVIRONMENT

The TST's first step was to review the teaching approaches used to support single-site delivery of the MSc. This preliminary analysis of teaching need led to the conclusion that the course could be extended to two sites by making use of a range of ICT technologies to create a VLE. The VLE elements or building blocks included:

*Virtual Interactive Teaching Environment*; would offer students at remote sites access to the lecturer via video-conferencing and data-conferencing. This facility could be used to support lectures, class discussions, tutorials and group work.

*Virtual Computer Lab Environment*; would offer students at remote sites access to computers to carry out their practical work. It would comprise a video-conferencing system for face to face contact with lecturing staff, telephone support for audio contact, and

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data-conferencing to enable lecturing staff to view and work with students on their material. This facility could also be used for tutorials, group work and project support.

This assumed that the remote sites would have access to:

*CCBL File server;* this would offer students access to resources associated with the course, space to store their own material, and a submission space used to submit projects to the lecturing staff.

*CCBL Web server;* this would be used to disseminate information about the course.

The TST's first step was to draw up a Framework Document, which comprised guidelines and acceptable standards for VLEs. This framework included guidelines for Virtual Interactive Teaching Environments and Virtual Computer Lab Class Environments, and allowed the Team to develop consistent and interoperable VLEs across different sites.

### **Virtual Interactive Teaching Environments**

The TST felt that it was important to gain a clear understanding of the lecturers' environment and the way in which they teach. They attended a number of traditional lectures, and identified a number of behaviours that would influence the design of the VLE:

- all lecturers drew heavily on the use of presentation systems to display MS PowerPoint slides and demonstrate software and courseware systems.
- students started a lecture by switching their attention between the lecturer and the presentation material being used, but as the lecture continued the students spent an increasing amount of time viewing the presentation material, only referring back to the lecturer occasionally.
- it was important that when the students did wish to make eye contact with the lecturer that the contact would appear "natural". This meant that the lecturer's framing monitor and the camera should be close together and be situated in a location that would allow the lecturer to treat them as an integral part of the class.
- most lecturers encouraged 'spontaneous' student participation, which must be audible to all students, and have the potential to be responded to by all students.

### **Production of Framework Document for Virtual Learning Environments**

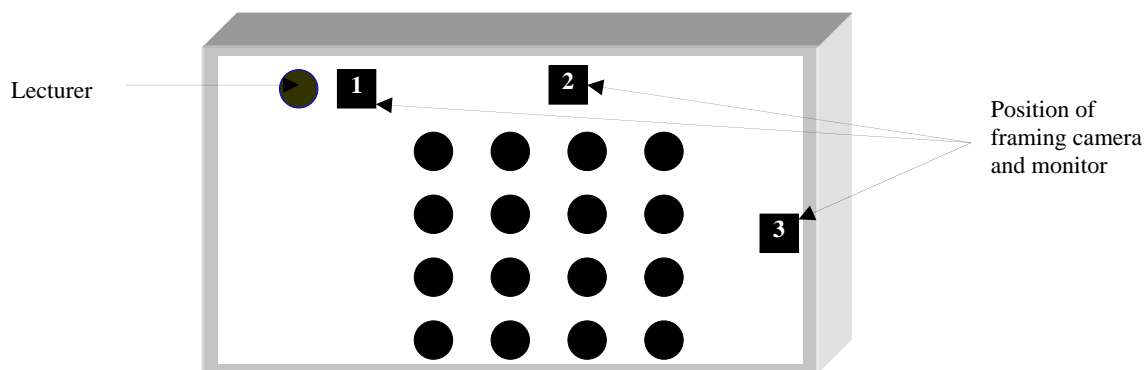
Taking these factors, and the pedagogical requirements (see *Appendix 1*) into consideration, the following framework for Virtual Interactive Teaching Environments was drawn up:

- Video and audio presentation to be facilitated by an H.320 compatible video-conference system, which offers full CIF screen presentation supporting at least 15 FPS.
- Video presentation to be displayed on a system which allows all students with 'normal sight' to see facial expressions on a head-shot. For example, a medium sized monitor

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can support a group of up to twelve students, twelve to fifteen require a large monitor, and above this number some form of projection system is required.

- The lecturer's camera to be accompanied by a framing monitor which displays the lecturer's image and the image of the students at remote site(s). Camera and monitor should be positioned close to the main body of students or built into a lecturer's console, and should allow the lecturer to view the monitor (and hence "look directly") at students attending the lecture at remote site(s). Consider the following configuration:



**Figure 2: Options for configuration of camera and monitor**

*Position 1* the framing camera and the monitor are built into the lecturer's console. This has the advantage of being close to the lecturer and so can be used to display high levels of detail. The disadvantage can be that the lecturer spends much of their time looking down at the monitor, which will affect their ability to project to the local students.

*Positions 2 & 3* the framing camera and monitor are placed close to the student audience. This has the advantage of offering a natural camera eye line for the lecturer. The disadvantage can be lack of detail visible to the lecturer.

- Camera position and control must allow students on any site to appear on camera. This may be facilitated through a wide-angle shot which covers the entire class, automated camera pan and zoom, audio/image homing facilities or camera switching.
- All sites should be able to host lectures, therefore a camera position to support presentation must be easily achievable.
- Data presentation should be displayed on a system which allows all students with 'normal sight' to read Times 10. This was required to support software and courseware presentations. For example, a group of up to twelve may be supported by a large monitor and above this number some form of projection system will be required.
- Data presentation system should support SVGA with at least 800 x 600 resolution and 256 colours.
- Sufficient access to microphones to allow all students to participate in the session must also be supported. In a small class of less than eight, a single microphone may be sufficient, above this number a multi-microphone set-up or some form of roving microphone should be available.
- Speakers with sufficient amplification to allow all students to hear a lecturer and other students speaking 'normally'.

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- Physical layout of the room must also be suitable for video and audio broadcast and reception. Issues include – uncontrollable sunlight, not enough light for cameras, rooms with acoustics which cause bounce back, dead rooms which ‘kill’ sound levels.
  - Local technical support must be provided.

### **Virtual Computer Lab Environments**

The TST attended a number of computer lab classes and concluded that the labs were used in two main modes: non-invasive one-to-one support for students working their way through lab exercises; and informal small group teaching to deal with points of interest or recurring problems.

Taking these factors into consideration, the following framework was drawn up for Virtual Computer Lab Environments:

- A Virtual Computer Lab Environment should include a small group Virtual Interactive Teaching Environment.
- The lab should have access to PCs, which number at least ½ the number of students on that site in any one year.
- All PCs must be connected to the Queen’s network and have access to the CCBL server, the WWW, and the Queen’s email service.
- PCs must be of sufficient configuration to support the core applications used on the course in conjunction with data-conferencing software.
- Local technical support must be provided.

### **Site Connectivity**

The Team identified the following elements for site connectivity:

- Each site must offer a minimum of one video connection through ISDN2 and a data connection with a minimum bandwidth of 128 Kbps to the Queen’s campus network.
- Additional features such as increased bandwidth for networking and video-conferencing support would be beneficial.
- The site must also offer telephone support.

## **IMPLEMENTATION OF THE VIRTUAL LEARNING ENVIRONMENT SITES**

In this first year of the course, sites on the main campus and the Armagh campus were required.

### *Armagh Campus*

A campus in Armagh was being established for the start of academic year 1995/96. The TST were asked to advise on the technical and pedagogic aspects of creating Virtual

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Interactive Teaching Environments and Virtual Labs Class Environments which could service the needs of a range of courses.

It was agreed that an all-purpose Virtual Interactive Teaching Environment, which could support up to 60 students and a Virtual Computer Lab, which could support up to 8 students should be established. Tables 2 and 3 outline the configurations of the Armagh site.

Dedicated room-based video-conference system with lecturer and student camera, and microphones throughout

Facilities to display documents, and play and record video material

Lecturer console with video framing and data monitor

Video projection systems for video-conference presentation

Data Projection system for data-conference presentation

Video-conference communication available via ISDN2 and a 384 Kbps G703

Data communication of up to 1 Kbps via a leased line

Telephone connection through local switchboard

Technical support supplied by local technician

**Table 2: Armagh Virtual Interactive Teaching Environment**

5 Pentium multimedia PCs connected to the Queen's network and running data-conferencing software

Desktop video-conference system which supported ISDN2

25" screen for video presentation

28" screen for data presentation

Telephone connection through local switchboard

Technical support supplied by local technician

**Table 3: Armagh Virtual Computer Lab Environment**

### **Main Campus**

The TST received funding from the Outreach Initiative to set up a small Virtual Learning Environment. This was used to create a Virtual Interactive Teaching Environment, which was complemented by an existing computer lab. Tables 4 and 5 outline the configurations on the main campus.

Roll-about video-conference system (inherited from another initiative)

Student camera

Lecturer camera

Video presentation monitor

Video framing monitor

Data projection system for data-conferencing

Data review monitor

Roving microphone

Technical support supplied by local technician

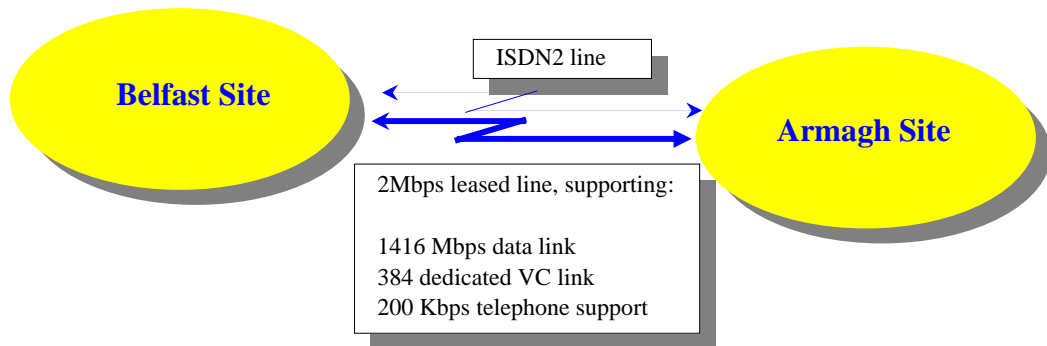
**Table 4: Main Campus Virtual Interactive Teaching Environment**

<p>15 Pentium multimedia based PCs connected to the Queen's network and running data-conferencing software</p> <p>Telephone support</p> <p>Technical support supplied by local technician</p>
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**Table 5: Main Campus Computer Lab Environment**

As can be seen from table 5 the main site computer lab did not offer large group data presentation or video-conferencing support. This was considered acceptable as the lab was beside the Virtual Interactive Teaching Environment.

*Site Connectivity*



**Figure 3: Site Connectivity**

As illustrated in Figure 3, a dedicated leased line and a standard ISDN2 line connected the Belfast and Armagh sites. The leased line was used to support data, video and telephone connectivity. This took the bulk of the traffic. The ISDN2 line was used as a fallback/overflow facility, i.e. it could be used if the leased line was already in use or was not working.

**Assuring Quality**

The taught element of the MSc comprised six modules. Three modules were delivered in the first semester and three in the second. Before each teaching session all video-conferencing, data-conferencing, data presentation and associated communications facilities had to be checked and made ready for teaching. This technically simple process was quite time consuming in the early stages of the course, taking up to thirty minutes before the start of the class. Problems included:

- establishing communications between the video-conference systems.
- running data-conferencing between the two sites.
- obtaining satisfactory audio levels without video-conference audio feedback.

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It was found that the fine-tuning of all systems to create more compatible configurations reduced most of these problems to an acceptable level. Examples of the fine-tuning included:

- Ensuring that all cables were properly connected (this sort of work has the potential to generate extremely complex cable layouts) led to a major improvement.
- Ensuring that all video-conference systems had H.320 compatible audio standards. Although all systems were H.320 compliant, some of them had difficulty identifying a common audio standard - software upgrades took care of this.
- Ensuring that PCs running data-conferencing had sufficient memory to support the buffering required for high-speed data transfer.

This fine tuning and the growing experience of the technical support staff reduced set-up time to an acceptable five to ten minutes.

## **Review of the Early Years**

In general, feedback from the staff and students involved in the MSc was very positive. The main issues were:

*teaching was more formal*; staff found that they could teach using these new facilities, but found the process much more formal, which meant that they had to work quite hard to stimulate student participation.

*reliability of the technology*; this was an issue, particularly at the start of the course. This would have caused more problems if contingency plans had not been in place. The main problems included the occasional inability of the network to offer the quality of service required for data and video-conferencing, and the relative unreliability of the ISDN2 connection to support video-conferencing.

*dissatisfaction with the size of the large VLE*; discussions with staff and students supported by observations from attending lectures and lab classes at the remote site made it clear that students were comfortable and relaxed when using the Virtual Computer Lab, but appeared rather lost and inattentive in the large Virtual Interactive Teaching Environment. The simple answer was to hold all lectures in the Virtual Computer Lab which, due to the small numbers of students, could meet the needs of virtual teaching.

## **MOVING TO A SECOND REMOTE SITE**

The review of the first year of supporting a remote site encouraged the staff of the MSc to expand to a second site. A number of groups had expressed an interest in acting as a host site for the MSc. After some consideration Omagh Further Education College (FE) was selected.

The TST were asked to establish a new Virtual Learning Environment in Omagh, review the Armagh site, and update all systems for multi-site video and data-conferencing.

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## **Establishing a new Virtual Learning Environment in Omagh**

The target number of students for the Omagh site was five to eight. Lessons learned from Armagh suggested that a combined Virtual Interactive Teaching Environment and Virtual Computer Lab Environment was the most educationally and cost effective method of creating a VLE for this number of students.

Working with staff from the FE College, the TST established a Virtual Computer Lab as outlined in table 6

5 Pentium PCs connected to a dedicated Local area Network hosted on a local server
1 desktop video-conference system with 25" monitor
1 desktop PC (Pentium with multimedia) with 28" data-conferencing monitor
Network printer
Telephone support
Local technical support

**Table 6: Omagh Virtual Computer Lab**

### Site Connectivity

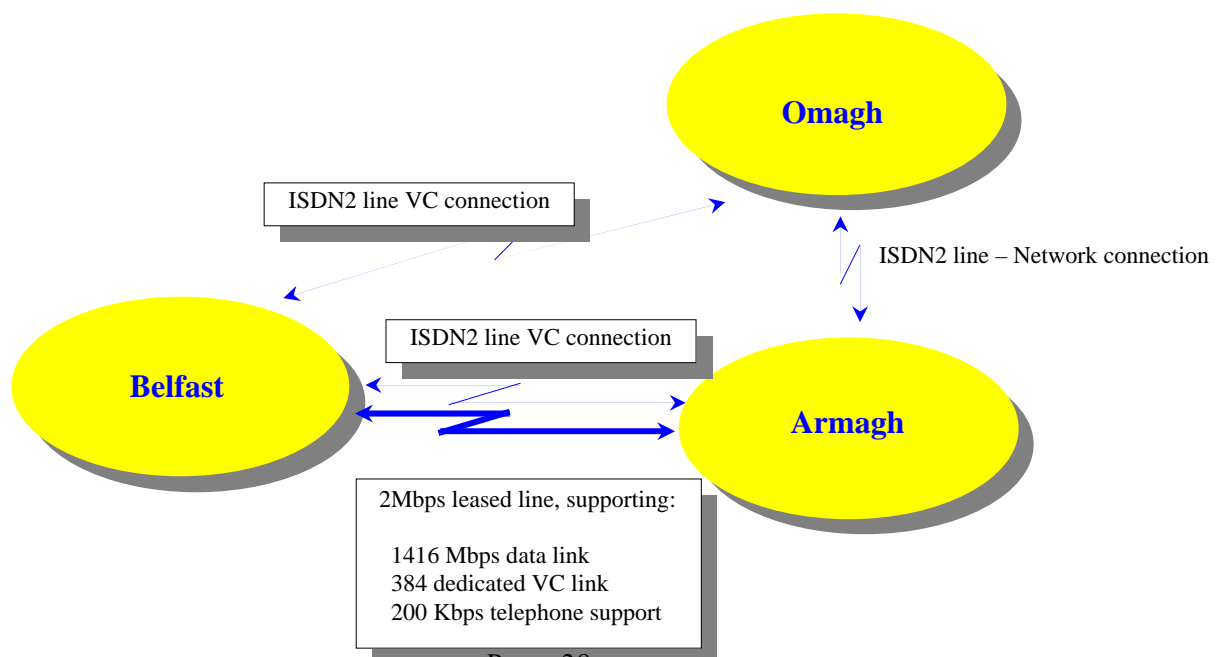
The leased line that had been used the previous year to connect Armagh to Belfast was still in place and would continue to service the needs of the Armagh site. Omagh, however, presented a challenge. It was envisaged that in time a number of courses would be hosted on the Belfast campus, and delivered to Omagh, but in the first instance the only course requiring site connectivity would be the MSc.

This led to the following specification of requirements for the Omagh site:

- Network connection at 128 Kbps for up to six hours per week.
- ISDN2 connection for video-conferencing for up to six hours per week.

The TST decided to provide video-conferencing ISDN support through a standard BT ISDN2 line and a second ISDN2 line would be used to support dial-up data networking. Data networking was supported through an ISDN bridge on the Omagh site and connected to a network gateway on the Armagh site.

This resulted in the following configuration:



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### **Figure 4: Three Site Connectivity**

ISDN dial-up connections are much superior to modem based connections. They offer:

- up to ten times the performance.
- very rapid set-up time which means connection latency is negligible.
- a sophisticated phantom service, which drops the live link when it is not servicing network traffic and transparently reconnects when required.

Testing of this connection assured the Team that ISDN could support up to five simultaneous data- conferencing sessions and provide very acceptable response times for email, WWW and file server use.

### **Moving to Multi-site Video-conferencing and Data-conferencing**

The data-conferencing and video-conferencing products, in use on the MSc, could only support point-to-point communication and so required upgrading or replacement.

Data-conferencing turned out to be the easier of the problems to solve – the current data-conferencing system was replaced by the beta release version of a new product called "NetMeeting" (produced by Microsoft). This free product offered a simple to use software that allowed users to join conferences simply by "dialing" in. This product was installed on all machines at each site and quickly became one of the main vehicles for communication.

It should be noted that the specification of T.120 the ITU standard for data-conferencing supported multi-site conferencing, but at that time no fully functional T.120 products were available.

The Team expected multi-site video-conferencing to present no major problems. The ITU H.320 standards covered multi-site conferencing and a number of universities and commercial sites offered multi-site conferencing services. The barrier turned out to be one of cost! The least expensive bureau service would cost over £8,000 to support the MSc. This figure did not include the call charges associated with ISDN lines.

The Team decided that the simplest solution was to run a second point-to-point video-conference session. This configuration allowed us to run parallel point-to-point video sessions to the two remote sites.

The second video-conference system was a desktop configuration, which included a very basic camera and microphone. In order to improve video quality this system was connected to the cameras associated with the roll-about system.

This was not a very satisfactory solution but was accepted as a short-term 'fix' for one year.

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## Review of the move to a Second Site

Results from the remote sites suggested that students were not being disadvantaged as a result of studying at distance. However, a number of issues did arise,

- The amount of physical technology (grey boxes!) required to support point-to-point video-conferencing was causing the teaching space to become a little crowded and 'busy'. This was more of an issue for the lecturers than the students but needed to be dealt with.
- Expansion in student numbers at the main site was resulting in major pressure on the available teaching space.

## THE PRESENT

A key feature in the on-going technical evolution of the MSc has been the establishment of The Peter Froggatt Centre for the academic year 1998/99. The Centre aims to create a centre of teaching excellence for the University and seeks to make effective and efficient use of technology to support teaching and learning.

The TST was invited to identify and develop the technical services required within the Centre. Drawing on their experience of the last three years, the TST was able to help create a facility that could support traditional, computer-based and virtual teaching. A description of the Centre may be found on Queen's teaching web pages at:

<http://www.qub.ac.uk/teach/>

The facility was designed with flexibility in mind. It offers:

- video-conference and data-conference sessions from any room.
- high performance ISDN6 video-conferences.
- state-of-the-art computer labs that can support video and data-conferencing.
- data projection and video-conference systems.
- access to Queen's network from all teaching rooms.
- evening and weekend access.
- a range of room sizes from 10 to 300 seats.
- two dedicated Virtual Lecture Environments, which can support up to 300 students.
- computing, audio visual and video-conferencing technician support.

It should be noted that ISDN support is made available throughout the facility by using spare structured network cabling. Six ISDN lines have been connected to the main network hub. Using this approach, ISDN can be connected to any room. By providing two double network connections in a number of key rooms, ISDN6 can also be supported.

MSc lecturing staff can request video-conference and data projection equipment to be supplied, when booking teaching facilities in the Centre. Computer labs, which support video and data-conferencing, are also available.

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## **Multi-site Video-conferencing**

Use of the Peter Froggatt Centre has meant that point-to-point video-conference sessions could no longer be used to offer quasi multi-site support. The establishment of the national Janet multi-site video-conference service hosted by Edinburgh University has addressed this problem very effectively.

The Janet service is excellent. It has proved extremely reliable, and it is recommended without reservation. Signing up for the service is straight forward – all video-conference systems are tested to ensure compatibility and common sound levels. Multi-site conferencing sessions can be booked as required. Running a multi-site conference is again straightforward – all sites simply dial into the service in Edinburgh.

## **CONCLUSION**

The technical evolution of the course has now reached a watershed. The TST was given the brief to create a Virtual Learning Environment that would make higher education more accessible across Northern Ireland. Further, the Team was asked to develop central teaching facilities that could support virtual teaching and learning. Both these briefs have been met.

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## CONCLUSIONS

Without doubt, there is a growing trend towards remote learning. Technology has developed, and will continue to develop rapidly. It is important that courses like the MSc in CBL continue to prototype and assimilate new technologies into their teaching and learning. The development cycle, which has moved from a course which was underpinned by an experimental technical support service to one that uses standard facilities at Queen's demonstrates this assimilation of technology into teaching.

Daniel and Marquis (1979) refer to the difficult synthesis which distance learning systems have to effect between those activities in which the student works alone and those, which bring the student into contact with other people. The challenge for the MSc course will be to achieve an acceptable balance between interactive sessions and student self-study in an expanding market where band-width and connection time will be critical. The future plans for the course involve integrating more technologies to provide greater flexibility and to help cope with increasing student numbers. One possible model would be to use resource based learning with asynchronous approaches such as computer conferencing supported by regular but not necessarily weekly synchronous events.

However, our experience, and that of many we have talked to has helped to highlight that, within this evolving context,

- the success of the VLE depends on the careful consideration and planning of the human, organisational, pedagogic and technical factors that influence the VLE.
- although a range of technologies can support a range of teaching methods, it is the approach of the lecturer and the way in which they decide to use the technology that is central.

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## APPENDICES

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## APPENDIX 1: GLOSSARY

**CIF;** Common Interchange Format. This ensures that screens of information can be displayed on any system which is CIF compliant. The CIF size is 352 x 288 pixels. The standard screen format for a PC is 800 x 600 pixels. In order to offer full-screen video-conferencing, many systems use 'pixel replication' to blow up CIF to full screen size. This is one of the reasons that some video-conference system images can appear very blocky.

**Data-conferencing;** supports point-point and multi-point conferencing. Systems may be proprietary or 'open', T.120 compliant. Data-conferencing features include whiteboards, file transfer and application sharing. This kind of sharing encourages collaboration and real-time feedback.

**Data review monitor;** a small monitor available to the lecturer. This allows the lecturer to see the information that is being displayed to students without the need to turn around to view the main display systems.

**FPS;** frames per second. This gives an idea of the speed, and hence video smoothness of the video-conference system. Video-conference systems range from 5 FPS for low cost software-only systems to 30 FPS for top end systems using up to 2 mbps network speed. Mid range desk top systems should offer around 15 FPS.

**Framing monitor;** this is used by the lecturer to ensure that they are in shot. This may seem trivial, but it is very important.

**H.320;** The H.320 recommendation seeks to ensure that any two video-conference systems can communicate with each other. The H.320 recommendation is a collection of up to 20 sub-recommendations. Many systems, which claim H.320 compliance, support only a subset of the full recommendations. As an example, we have experienced systems that support different sub-sets of the audio recommendations, so could not communicate! So, before purchasing any H.320 equipment, it is recommended that if possible test it with any key systems that it will be used with.

More information about H.320 can be found at: <http://www.imtc.org/h320.htm>

It is also worth checking with the Janet Video Conferencing Services for up to date information on H.320 systems. The Janet Video Conferencing Services can be viewed at: [http://www.ja.net/service\\_development/video/service/](http://www.ja.net/service_development/video/service/)

**ISDN;** Integrated Services Digital Network. ISDN can be purchased in building blocks of 64 kbps. The most common combination is ISDN2, which is used to support desktop video-conference systems, and ISDN6, which is used to support high-end video-conferencing. Some features of ISDN links include:

- Calling Line Identity Presentation (CLIP) - used to identify and if necessary authenticate the caller.
- 5-10 times the real data transfer performance of a modem.
- very rapid set-up time which means connection latency is negligible.
- a sophisticated phantom service, which drops the live link when it is not servicing network traffic and transparently reconnects when required.

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More information about ISDN can be found at: <http://www.isdn.bt.com/> or <http://www.cabletel.co.uk/>

**ITU;** International Technology Union is the group who draws up the internal recommendations for video and data-conferencing. Further information may be found at: <http://www.imtc.org/standards.htm> or <http://www.itu.int/>

**Kbps;** kilo bits per second. This is used as a measure of network speed. Some examples include,

- modems - usually 28 or 56 kps
- ISDN2 128 kps
- Local area networks - 10,000 kbps (10mbps) -155,000 (155 mbps)

**QCIF;** Quarter Common Interchange Format. This ensure that screens of information can be displayed on any system which is QCIF compliant. The QCIF size is 176 x 144 pixels.

**Roll-about Video-Conference System;** offers a 'shrink wrapped' video-conference system. Roll-about are ideal when PC literate staff are not available and in corporate environments.

**T.120;** The T.120 recommendations ensure that any two data-conferencing systems can communicate with each other. The recommendations include standards for whiteboards (i.e. sharing graphical images), file transfer and application sharing. Further information about T.120 may be found at: <http://www.imtc.org/t120.htm>

**Video-conferencing;** Video-conferencing supports two-way video and audio communication. This means that two or more people at different locations can see and hear each other at the same time. There are basically two types of video-conference sessions: point to point and multi-point.

**APPEDIX 2: OUTLINE OF THE TEACHING METHODS USED ON THE COURSE PRIOR TO THE VLE**

<b>Approach</b>	<b>Aim and description of the approach</b>
<b>Lectures</b>	<p>The aim of this approach is to present an overview of issues, to provide information and explain concepts. It is frequently used before group work or practicals.</p> <p>Typically, a lecture involves using a computer to deliver slides/overheads (using MSPowerpoint) and to demonstrate CBL software. Students can interact by asking questions or the lecturer can ask questions or set activities for the students.</p>
<b>Practicals</b>	<p>The aim of this approach is to provide students with an opportunity to develop and practice skills such as IT, programming or authoring skills.</p> <p>The student works through a paper-based practical, at the computer. The lecturer and an assistant is present, observing what they are doing and responding to queries as required. These could vary from simply answering questions to actually showing the student something on the computer - all activities might require the lecturer to view and examine the student's work on screen.</p>
<b>Group work</b>	<p>The aim of this approach is to provide the students with an opportunity to discuss and articulate their ideas and share experiences.</p> <p>Group work involves the students focusing on a project/problem/case study and discussing it in small groups. The lecturer is present, observing the students, moving from group to group and responding to queries as required. Then the groups, generally, come together to present and discuss outcomes with input from the lecturer.</p>
<b>Project supervision</b>	<p>Students carry out projects and produce dissertations. The project aims to provide the students with an opportunity to apply the knowledge and skills acquired throughout the course.</p> <p>Each student meets regularly with their supervisor to discuss their project ideas. The meetings will initially focus on choosing and clarifying the topic the student will focus on. Throughout the project, the student provides their supervisor with material, both paper-based and software for comments and the student and supervisor will meet to discuss feedback on that material, plan future work, etc.</p>
<b>Tutor support</b>	<p>Students can arrange to see a lecturer to discuss assignments, projects, difficulties with the course, etc. Although, each student had an email account to communicate with their tutors and fellow students, they typically call into the CCBL to make an appointment and meet with a tutor.</p>
<b>Resources</b>	<p>A range of resources is available to support the students' study.</p> <p>Each module is provided with a 'work space' on the CCBL central server to enable access to course materials such as lecture notes, software and CBL</p>

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	exemplars, etc. Students also have access to books, journals and off-prints in the library. Each student has their own 'personal space' on the CCBL central server to both store and submit work for assessment.
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