The Use of MANs Initiative

Achievements, Outcomes, Recommendations

INFORMATION

To: Higher Education Institutions

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Foreword

I am very pleased to introduce this report, which details the achievements and outcomes of the SHEFC Use of MANs Initiative (UMI).

The origins of the UMI go back to 1994, when the Council decided to accelerate existing plans for providing Scottish higher education institutions with broadband network connectivity. The Scottish MANs formed, at that time, a world-class network infrastructure, offering speeds and capabilities to rival the best in the world. The value of this investment could only be realised by exploiting the capabilities of the network and promulgating the benefits throughout the Scottish HE sector. The UMI attempted to do this by supporting a wide variety of projects and activities, ranging from technical explorations of the technology and the development of managed services to credit-bearing network-delivered learning and teaching. The people involved in these activities gained first-hand knowledge of the capabilities of the MANs. They discovered what was technically feasible and what was practical; what was found useful by staff and what motivated students. They worked outwith their institutional boundaries to collaborate with each other in new and deeper ways.

Exploration always involves an element of risk, of resolving one challenge only to be confronted by another. In exploring the capabilities of the MANs institutions encountered new barriers and issues to be resolved, and they were not always successful. The purpose of this report is to document these experiences for the wider higher education community. It is by learning from such experiences that the higher education sector can develop new approaches to the business of learning and teaching. I hope that you will find this report of interest.

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Acknowledgements

It has been a privilege to work with the UMI project holders, and I would like to thank them for their co-operation.

I would like to thank Professor Alastair MacFarlane, the original chair of the UMI Steering Group, who supervised the setting up of UMI and was very supportive to me at the start of my work for UMI. Dr Paul Clark chaired the UMI Steering Group from January 1998, and provided much guidance, encouragement and good advice during the two years of UMI Phase 2. Dr Bill Harvey has been very helpful during the preparation of this report. Gerard Madill and David Beards were both good colleagues to work with, providing valuable insights when these were needed.

The members of the UMI Steering Group were a source of encouragement and advice both to me and to the projects funded under UMI. Professor Fred Percival has been very supportive of my work and I have greatly appreciated his advice on many occasions.

My successive assistants, Anne Spalding and Kim Underwood, provided invaluable support and comradeship as we worked out together how to undertake some initially daunting tasks. The report was typeset by Margaret Nairn.

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1 Introduction

The Use of MANs Initiative funded the development of materials and techniques for online learning: a year after Phase 1 funding had ceased, thirty-six of the resources formed part of credit-bearing courses, and over three thousand students were using materials created with UMI funding. Videoconference rooms were installed at every Scottish HEI, and the network itself was upgraded and extended.

This report presents the major achievements of projects funded by UMI, excluding work on the physical network infrastructure. Outcomes, issues and recommendations identified by the Co-ordinator are discussed, and since the first phase of projects was nearing completion at the time of the Co-ordinator's appointment, it has been possible to identify some of the problems that only emerge once project funding has ceased. New insights included the pedagogical opportunities afforded by a pervasive network, issues of project processes and project selection, technical innovation, and have resulted in recommendations that may help to identify and shape further work.

It was found that a wide mix of skills was needed in project teams, and projects reported that until they had access to a more robust authentication mechanism, their online learning environments would not be able to be used to their full potential. It was found that a co-ordinated dialogue is needed between technology providers and teaching and learning experts when planning infrastructure expenditure, and that high-level decisions may be needed if facilities are to operate on a national basis.

Collaborative task-based teaching, groupwork, resource based learning and problem based learning were all successfully developed by UMI projects. Collaboration was an important feature, both in Phase 1 where many projects involved contributions from several HEIs, and in Phase 2 where all projects were collaborative both in developing materials and methods and in delivery of credit-bearing undergraduate courses.

UMI funded the development of high-quality videoconference rooms, which are now available free at point of use for staff of Scottish HEIs. The projects were innovative in their use of the rooms for teaching and learning, and their work developed new possibilities to add to the student experience of university education in Scotland.

Hardware innovations were investigated; a video-clip server was installed and is now in use; high-quality audio was developed for use in teaching music students; network monitoring software was installed. The network was extended and improved.

Some of the experiments failed; some of the new technologies turned out to be incompatible with each other; some projects were technically successful but did not achieve all of their original aims. It is not possible to know what can be done until some experiments have been tried, and the experience gained makes it possible to take advantage of the later technologies which are becoming available.

Challenges remain. The use of the new technology must be embedded in the fabric of university life, empowering staff to use these tools to enhance their work if they feel it appropriate. Novel uses of the network remain to be explored, and refinements are needed to the work already started; the process of testing and adaptation is likely to go on for some time.

Advances in learning technology are the result of a partnership between technical innovators and learning and teaching innovators. Technological developments spark ideas for novel usages, which in turn lead to refinement of the technology available. UMI was the work of early adopters and innovators, and we now need a period when the results of their achievements, and the capability of benefiting from them, are made available to a wider number of colleagues wishing to adopt the new techniques.

The outcomes and issues reported here emerged from project meetings, project reports, phone calls from project holders, discussions during seminars and workshops, and a survey of Phase 1 projects. This report can inevitably only present an outline of what has been achieved, but reference is made to the UMI website where further information is held for all of the projects.

The report will be of interest to many parts of the UK Higher Education community: those working in the application of C&IT within teaching and learning, those with an interest in the use of computer networks within Higher Education, and those planning network provision for HE. It will be useful to those preparing bids for new projects in this area, and contains lessons for those who have the task of selecting projects for funding.

In 1999 SHEFC launched a new C&IT Programme which will build on many of the lessons and achievements of UMI. Information about the new Programme is available at http://www.scotcit.ac.uk/

This report is available online at the UMI website, http://www.use-of-mans.ac.uk/ which also contains a short description of each project.

2 Summary and Recommendations

This chapter presents very brief summaries of the work and issues explored by UMI. Section references are given to later chapters where the topics are presented more fully.

2.1 ONLINE LEARNING

2.1.1 Collaborative development of teaching materials

Several projects involved collaboration between staff of different HEIs. Interesting methods were used to select what materials would be produced: one project held a session in which different HEIs bartered their willingness to carry out further development to their existing materials (4.6.1) and then to make them available to the community. Projects found that their activities resulted in carrying out a review of the curriculum, either explicitly or as a side-effect of their collaboration (4.6.2). The academic members of one project decided to review all the materials that had been created by their consortium and to give a collective 'stamp of quality' for the online materials (4.7.6) that had been created. It was reported that a wide mix of skills was needed in teams producing online learning materials (4.6.4) and it was felt useful to reward contributors (4.6.6). Techniques were found for overcoming the 'not invented here' syndrome (4.7.5). Projects reported that they spent a disproportionate amount of time training staff (9.1.1), and that the experience gained by project members was often lost at the end of the project (9.1.2). They reported that they did not have a long enough funding period to be able to carry out summative evaluation (9.1.3). Effective teams were formed and then disbanded at the end of the funding period (9.1.4). Projects noted a particular difficulty in retaining experienced technology developers (9.1.5). Not all projects had developed exit strategies (9.1.6). Projects wanted to develop more materials, building on their UMI achievements (4.5.8).

Recommendation (1)
Project duration of less than two years may not allow efficient use of the funding provided.

2.1.2 Maintenance of teaching materials

Uptake and use of materials after projects had ended was not guaranteed (7.1.2), and long-term maintenance of materials (4.10.2) was sometimes more complicated if they had been produced collaboratively. The ownership and use of specialised equipment at the end of funding (4.10.4) was an issue. Decisions were needed about the copyright of materials at the end of funding (4.10.3). Web servers needed to be maintained, and expertise to do this was not always available after the end of funding (4.9.4); teachers needed to have confidence that servers would be immediately available if they were to use materials stored on them in live teaching sessions (4.9.6). Some consortium members found that they did not automatically have access to the project server and its materials after the end of the project (4.10.1).

Recommendation (2)
Teaching and Learning materials produced by UMI projects and from other sources may become unavailable to staff at Scottish HEIs after the end of funding. It is recommended that SHEFC consider making them available on a centrally-funded server either for download and use locally, or for online access.

2.1.3 Using multimedia computers

Learning materials included features not possible without use of computers, for example self-assessment materials (4.3.3), use of simulation to allow students to explore the implications associated with decisions (4.5.5), use of video clips to illustrate processes (4.5.3), use of animations (4.5.1), use of sound (4.5.6), use of film material to substitute for socially problematic procedures (4.5.4), using different types of material linked together more effectively than would have been possible using paper (4.5.2), making scarce resources available for teaching (4.5.7).

2.1.4 Online pedagogy

The online environment was used for task-based learning (4.1.1, 4.1.2) and vicarious learning (4.1.3). It was found that students developed a less formal relationship with remote teachers (4.1.4), and that students liked to use paper-based materials to complement online multimedia packages (4.4.2). Projects created and used online learning environments (4.3). A software system was developed to support online groupwork (4.3.1).

2.1.5 Re-usable learning materials

An efficient way to increase the usefulness of online materials, and to get the maximum benefit from the quite large expense of developing them, was to develop small modules so that teachers could 'pick and mix' (4.7.2) from the modules in order to put together a unique course for their own purposes. Another way of maximising their usefulness was to create materials suitable to be used as part of a range of courses (4.7.1). One project used a system whereby the content of online materials could be created without specifying how it would be presented to the students; different users of the materials could therefore create an appearance that fitted in with their teaching style, or conformed to a local house style (4.7.3).

2.1.6 Using MANs to deliver teaching materials

An advantage of producing web-based materials was that they could be accessed by students anywhere in Scotland (4.8.1), and the latest version of the materials was always instantly available online (4.8.2). Materials held on servers within individual HEIs were distributed to users at different HEIs (4.8.3). It was found that MAN-based materials could be used in teaching sessions (4.8.4).

2.1.7 Issues to do with online learning systems

The usefulness of materials which were solely available via the world wide web was limited in that students had to be connected to the network in order to use them (4.9.1). Multimedia teaching materials were best viewed from direct MAN connections (4.9.2). Projects reported that students needed to be encouraged to use the online environment (4.4.5). Problems with access were experienced in congested local area networks, even though the MANs were adequate and reliable (4.9.10).

Recommendation (3)
If online multimedia materials become an important learning tool, students will need easy access to terminals connected to the MAN. This means that improvements will be needed to local network infrastructure.

2.1.8 Need for online authentication systems

Suitable authentication systems were not available for online learning environments, and this lack hindered expansion of their usage (4.4.6, 4.9.9).

Recommendation (4)
Presently available authentication systems do not have a sufficiently wide functionality for the requirements of online learning environments. More work is needed in this area.

2.1.9 Vulnerability of online materials

It was noted that materials that were available solely on web servers could become completely unavailable if the server was not maintained (4.9.5, 4.10.1).

Recommendation (5)
Online teaching materials may be lost unless a secure online repository is established.

2.2 USE OF VIDEOCONFERENCING

2.2.1 Teaching and project communication

Projects reported that the videoconference facilities could be used for teaching, and this both reduced the amount of time that tutors spent travelling, and enabled tutors to teach a larger audience (6.4.1). Students were given access to a wider range of expertise (6.4.2), and were able to form a more informal relationship with remote teachers (4.1.4). The videoconference rooms were very successful in enabling project communication and support (6.4.10, 6.4.11).

2.2.2 Improving the videoconference facilities

Projects reported that the layout of the videoconference rooms could be greatly improved for teaching purposes (6.5). Teachers wanted to be able to display web-based materials (data and slides) at remote sites during teaching sessions (6.4.3).

Recommendation (6)
If the videoconference rooms are to be widely used in teaching, their layout may need to be altered. Provision of data-sharing facilities will increase the usefulness of the videoconference rooms.

2.2.3 Advantages of the managed network

The videoconference studios were part of a managed network, and as a result booked rooms were pre-configured and ready to use (6.2, 6.2.1). This meant that people with little previous experience could use the rooms (6.2.2).

Recommendation (7)
Any future videoconference facilities would benefit from being part of a centrally managed system.

2.2.4 Free use of videoconference facilities

The videoconference rooms communicated over the network and hence were free at point of use for members of staff at Scottish HEIs. This was thought to encourage usage (6.2.3).

Recommendation (8)
Any future videoconference facilities should communicate over the network and be free at point of use.

2.2.5 High quality videoconference facilities

The videoconference facilities provided near broadcast quality video and audio, the audio being mixed (6.3.2, 6.3.3). Some academics thought that this high quality enabled them to use the studios in ways that would not be possible with less good quality (6.3.3); the high quality was thought to be important in enabling effective meetings and seminars (6.4.10, 6.8.1).

Recommendation (9)
Any future videoconference facilities should offer very high quality video and high quality, mixed, audio.

2.2.6 Policy on access to videoconference rooms

The keys of most of the videoconference rooms were held by technical staff (6.4.15) though some rooms could be opened by secretarial or reception staff. Staff requested the facility to book videoconference facilities at different HEIs but this raised several issues (6.4.16).

Recommendation (10)
The videoconference rooms would be more accessible through non-technical staff who were located near to the rooms, and it is recommended that where possible this should be the norm. It would be desirable if the rooms could be used as a national facility, with staff able to make use of rooms at different HEIs.

2.3 STAFF DEVELOPMENT

2.3.1 Promulgating appropriate usage

Projects promulgated appropriate usage of the online environment (7.1.4).

2.3.2 Issues

There was a need to provide staff with broad-brush awareness information on the facilities that had been made available (7.1). This included a need for help in starting to use C&IT (7.1.1). A regional web support officer was very successful and there was demand for more support of this sort (7.1.3).

Recommendation (11)
Region-based support for web developers may be appropriate. Provision of local HEI-based support and awareness is recommended by the UMI project which investigated this.

2.4 PLANNING TECHNOLOGY PROVISION

2.4.1 Infrastructure

The technological infrastructure differed between HEIs (8.1.1) and this needed to be taken into account when promulgating its use.

2.4.2 Issues to do with technology planning

Network infrastructure planners tried to find sources within the academic community who could predict future network needs, but found this difficult (8.1.2). It was difficult to establish a process to balance need reported from teachers, against the cost involved in supplying equipment to fulfil the need (8.2.1).

Developing the usage of publicly-funded equipment involved high-level policy decisions by HEIs (6.4.16). Projects which had been funded to explore novel ways of using the network reported difficulty in finding funding to enable them to develop successful projects into long-term services (8.3).

Recommendation (12)
Many decisions need to be considered by experts in both communication and information technology, and learning and teaching experts. More dialogue is needed between these two groups.

2.5 BUILDING ON THE WORK OF OTHER INITIATIVES AND PROGRAMMES

2.5.1 Issues

Use of the network was not as important for some projects as for most (9.3.1). Projects developing facilities for use by other HEIs found that there was little takeup of their services (9.2.2).

Recommendation (13)
Some of the projects failed to realise all of their original aims, some carried out work which may have been more appropriate to a different initiative, for reasons that might in future be predicted. These reasons should be brought to the attention of future selection committees.

2.5.2 Importance of software standards

One project reported that its work was hampered because it had planned to use software developed by a previous project, but found that the software was not suitable (9.3.2).

Recommendation (14)
Resources developed by SHEFC-funded projects need to be made available to future projects. Training materials, software systems, and other resources need to be robust, and to be documented and maintained for use by future projects and initiatives.

2.5.3 Some products suitable for re-use

Projects developed products which had the potential for re-use by different groups or in different subject areas (4.1.3, 4.3.1, 4.3.3, 4.7.1, 4.7.3, 4.7.7).

Recommendation (15)
Projects produced systems with potential for uptake and re-use in different subject areas. Follow-on funding may be appropriate for these projects.

2.5.4 Levels of evaluation

Different projects carried out different types of evaluation (10) of varying levels of thoroughness. The evaluation strategies of the UMI projects varied widely; some produced very thorough evaluation reports, while others carried out less evaluation.

Recommendation (16)
New projects need guidance on the level of evaluation that SHEFC will expect from them.

3 Structure of UMI

3.1 BACKGROUND

In 1994/95, the Scottish Higher Education Funding Council (SHEFC) allocated £2.4 m to a programme to improve computer networking across the Scottish Higher Education (HE) sector. Four Metropolitan Area Networks (MANs) were established and almost all of the Scottish Higher Education Institutions (HEIs) were connected to their local MAN; SHEFC later funded the interconnection of the four MANs.

The Use of MANs Initiative (UMI) was set up and funded by SHEFC during academic years 1995–1999. The first phase of funding took place during 1995/96, and a second phase of funding was made available during academic years 1996–1998, with a few projects extending into academic year 1998/99. Since many of the original UMI proposals contained elements aimed at the development of videoconferencing, it was decided to co-ordinate these activities, and SHEFC provided funding of £1m in order to make videoconferencing possible across the Scottish HE sector.

A Steering Group was set up in 1995 under the chairmanship of Professor Alastair MacFarlane, to advise SHEFC on the form that UMI should take, select the projects funded in Phases 1 and 2, and oversee the implementation of UMI. The membership of the Steering Group is given in Appendix D.

3.2 PHASE 1

The first phase of UMI funding was used to support 69 projects, each of which was categorised as belonging to one or more of three 'strands'.

Strand 1 projects were concerned with hardware – network improvements, installation of servers etc.

Strand 2 projects explored different ways of using the Metropolitan Area Networks.

Strand 3 projects carried out staff-development activities. By far the largest amount of funding for Strand 3 was directed to the TALiSMAN project.

3.3 PHASE 2

The second phase of UMI provided funding for six projects, each of which involved a collaboration between staff based at more than one Scottish HEI. The projects all addressed the aim of integrating the use of MAN technology into credit-bearing courses.

3.4 VIDEOCONFERENCE FACILITIES

All Scottish HEIs were offered funding to install high-quality ATM-based videoconference facilities. Nineteen of the 21 institutions accepted this offer. A second round of funding was made available to install second rooms where these could be used for teaching purposes.

3.5 CO-ORDINATOR

The Co-ordinator for UMI was appointed in November 1996. Her remit was to monitor projects, report to the UMI Steering Group on projects' activities, assist in project evaluation, support projects, liaise with other C&IT-based initiatives in the UK, and disseminate the achievements of UMI to the higher education community in the UK.

3.6 FUNDING

Levels of funding for UMI are given in the following table.

Purpose	**Date**	**Funding**
Establish MANs	94/95	£2.4m
Establish interconnection	95/96	£750,000
UMI Phase 1, Strand 1	95/96	£2.5 m
UMI Phase 1, Strand 2 and 3	95/96	£1m
TALiSMAN	96/98	£680,000
TALiSMAN	98/99	£257,000
UMI Phase 2	96/98	£820,000
Videoconference studios	95/98	£1m
Co-ordination	96/98	£100,000
	Total	**£9.3m**

3.7 EVALUATION

A formal evaluation of the TALiSMAN project was commissioned by SHEFC and carried out in 1998. The UMI Co-ordinator obtained reports from the other Strand 2 and Strand 3 projects, and visited most of them. She also sent out a survey to all the Strand 2 projects that had produced teaching material. The Co-ordinator was able to monitor the progress and achievements of the Phase 2 projects, and she held discussions with individuals and groups throughout Scottish and UK HE.

3.8 FUTURE PLANS

In 1999 a new C&IT Programme was launched by SHEFC, which builds on the work of UMI and benefits from some of its lessons. Details of the SHEFC C&IT Programme are available at http://www.scotcit.ac.uk/

4 Learning Online

UMI projects explored the teaching opportunities provided by multimedia computers and not available through printed materials; they experimented with use of advanced communication technology in task-based and collaborative teaching; they reported on issues of developing and delivering courses collaboratively, and the issues associated with relying on communication technology. The examples below represent only a small sample of the achievements of the projects funded by UMI.

All materials developed by UMI projects were designed for access over the web. This meant that students could access them from computer laboratories, or from home computers with modems. While many projects developed new materials, several also converted existing materials which were formerly used either on CD-ROM, local hard disks, or other non-networked means.

4.1 TASK-BASED LEARNING

The online environment offered new possibilities for task-based teaching. Interactivity could be built into training materials, and the rich communications environment of discussion groups and email feedback was used as well.

4.1.1 Carrying out tasks on the web

The modules developed at St Andrews University for computer science students allowed the students to compile pieces of computer program code using the world wide web, and to receive feedback on the results. The National Learning Network for Remote Sensing developed Java-based virtual laboratories in which students could use image-processing tools.

4.1.2 Task-based collaborative teaching

The MANTCHI project developed task-based courseware in which students were required to collaborate with other students. Sometimes both teacher and students were at the same HEI, sometimes students were taught by remote experts from a different HEI, and students in one module were required to develop multimedia materials which were then assessed by a partner studying at a different HEI. Collaboration made use of room-based and desktop videoconferencing, email and systems such as shared whiteboards.

4.1.3 Vicarious learning

The MANTCHI project used the online environment to experiment with vicarious learning techniques, where students were given access to the work and experiences of former learners; these were stored and made available via the world wide web. The MANTCHI Answer Garden (MAG) software was developed to manage the storage of online information exchanges.

MANTCHI delivered courseware as a collection of ATOMs (Autonomous Learning Object in MANTCHI), which contained a mix of tasks. TRAILs (Tertiary Re-usable ATOM Instantiated for Learning) were developed, storing the work and information exchanges that took place during the use of particular ATOMs.

4.1.4 Relationship with remote teachers

In the MANTCHI project, while students might be taught certain topics by teachers at a distant HEI, assessment was always carried out by the local teacher. It was found that students felt freer to discuss and challenge the judgements of the remote teacher, since he or she would not be contributing to their assessment.

4.1.5 Supporting problem-based learning

The MedicalMAN project at the University of Glasgow used the network to support the new resource-based learning curriculum which was introduced in 1996. The new curriculum gave students a wide choice in what they studied, and individual students were able to join different groups for different subjects; no two students needed to study the same course. The network was used by this project to keep the students in touch with each other, and with staff – to keep them informed about teaching sessions and seminars, and to make course materials available.

4.1.6 Resource-based learning

The Child Health Medi-CAL project developed model patients which enabled medical, nursing and other students to investigate diseases and their management using online case studies.

4.2 DELIVERING COURSES COLLABORATIVELY

4.2.1 Students from different HEIs work together

The Remote Sensing and MANTCHI projects enabled students from different HEIs to work together, commenting on each other's materials, and taking part in the same discussions.

4.2.2 Materials used in courses at different HEIs

It was estimated that a minimum of 1,680 medical students would make use of the Child Health Medi-CAL materials each year. The materials would form a resource that would be shared by medical schools. The Remote Sensing materials would be used by students at HEIs throughout Scotland, as would the materials promulgated by the SUMSMAN project for use in service mathematics courses.

4.2.3 Teaching as part of credit-bearing courses

The MANTCHI ATOMs were designed to fit in with the Scottish Credit Accumulation and Transfer (SCOTCAT) scheme. The Remote Sensing courseware was used as part of credit-bearing courses, and the CVU developed materials which were part of courses, and were only presented over the network. The Finesse materials were part of mainline teaching activities, and hence were subject to the same quality assurance measures as other courses. The MANTCHI project noted a need to be able to automatically verify student selection of modules, to ensure the coherence of proposed programmes of study.

4.2.4 Collaborative course delivery

Project members delivered lectures and tutorials simultaneously to students from different Scottish HEIs, making use of the videoconference rooms. The experiences of both staff and students were recorded in evaluation studies. The Remote Sensing lectures and seminars used commercial software to share web-based materials between all studios, and to show slides at all studios in a conference. The SUMSMAN project used a scan convertor and the visualisers present in all the videoconference rooms to enable all rooms to share personal computer (PC) materials. This was found not to be as successful as other techniques of sharing PC work.

4.2.5 Supporting teachers using others' courseware

The MANTCHI project felt that it was important to provide supporting information for teachers who would use the ATOMs that had been placed online. They pointed out that only after the end of funding would it be known whether teachers would continue to use the ATOM material without the motivation of participating in a funded project.

4.3 ONLINE LEARNING ENVIRONMENTS

The Clyde Virtual University (CVU), Finesse, and National Learning Network for Remote Sensing provided online learning environments which included online discussion groups, self-assessment facilities, and feedback mechanisms between tutors and students. Informal online communication was also encouraged.

4.3.1 Groupwork

The Finesse project developed an online learning environment to support the use of a network-based spreadsheet package which had been developed during the UMI Phase 1 project B-CSCW (Broadband Computer Supported Co-operative Work). The spreadsheet could be accessed across the network, and different areas of a worksheet could be assigned to different members of a class. A student's area was private and could not be accessed by other students; however, the tutor could make information available to students, and could inspect the work of individuals. Stockmarket data were imported to the spreadsheet from a commercial source and this enabled the students to play a finance game in which they each managed a share portfolio. Email messages were triggered automatically and sent to the tutor if students failed to carry out certain tasks satisfactorily (for example if they purchased stocks without first obtaining appropriate sectoral statistics).

4.3.2 Desktop videoconferencing

The Finesse project used desktop videoconferencing based on Mbone technology, in conjunction with the spreadsheet software, so that students and teachers at different locations could see and talk to each other while manipulating the shared spreadsheet.

4.3.3 Self-assessment engines and materials

Several projects developed assessment engines - programs which enabled teachers to construct and provide over the network self-assessment tests for students. Tools were developed by Remote Sensing, Finesse, CVU, FAB, and CLUES. The CVU carried out further work on the tool that it had created in UMI Phase 1; SUMSMAN used an assessment tool developed within the mathematics department at Heriot-Watt University, and developed assessments for use with the Mathwise package which were made available to departments throughout the sector. The National Learning Network for Remote Sensing project developed pre- and post-lesson knowledge tests and evaluated students' use of these.

4.4 FEEDBACK ABOUT ONLINE LEARNING

4.4.1 Student and teacher comments

The SUMSMAN project evaluated student and teacher experiences and found that the two groups reported different perceived benefits and different wish lists of possible future improvements to C&IT-based Teaching and Learning.

The teachers felt that the most useful features of online teaching were practice questions and animated diagrams, and the ability to cover material as many times as needed. Many teachers felt that summative assessments were necessary to facilitate deep learning. SUMSMAN students requested access to bulletin boards of Frequently Asked Questions (FAQs), faster computers, a greater number of computer labs, and marked homework sheets with feedback.

4.4.2 Paper-based materials to complement multimedia packages

The SUMSMAN project developed learning guides which were designed to be used in paper form, in conjunction with the computer-based materials whose use they were promulgating. While the

teachers questioned by the SUMSMAN team were neutral on the usefulness of the paper based materials, 74% of students questioned found them 'very useful' and 60% of students who did not have access to paper materials included them in their wish list of possible improvements.

One of the MANTCHI evaluation studies included student comments that it took longer to scroll text material on a computer screen than to read paper-based material; some referred to the 'world wide wait'. They pointed out that paper-based materials can be read anywhere, without being limited to proximity to a network point. This project reported that its students preferred to print out the materials that were provided online, and since the materials described tasks and were not multimedia based, this was possible for them to do. Feedback from students indicated that this was a useful way to make materials available; the students liked to be able to annotate the paper-based materials, and to study them away from the computer. However the multimedia elements of the course were valued because they provided facilities that would not be possible with paper-based materials. The Remote Sensing project reported that its students preferred to have a paper copy of the text-based elements of the course, which they used for study away from the computer, and in conjunction with the multimedia elements of the course.

4.4.3 Design of online assessment engines

Self-assessment materials were reported by the projects to be popular with students as an aid to learning.

Students commented however that while paper-based tests allowed them to review all the answers before submitting a test as a whole, the online tests required that each question was submitted separately. Students wished to be able to go back to previous questions and refine their answers as they progressed through an online test.

4.4.4 Annotating scripts online

The MANTCHI project pointed out that when marking paper-based work, teachers can annotate, write comments, and use diagrams in a way which was not possible when marking materials submitted electronically. Hence the feedback that could be given for materials submitted and marked online was limited and different in nature from paper-based feedback.

4.4.5 Encouraging students to use the online environment

All projects using online learning environments reported that students needed to be encouraged to take part in online discussions, and that these normally had to be initiated by a member of staff. The Remote Sensing project reported that discussion boards needed to be seeded with messages which then stimulated responses from students.

The MANTCHI project found that making materials available on the web was not enough on its own and that students would not necessarily find or use such materials; if feedback for students was made available on the web, they needed an email message to alert them to go to the web to find it.

4.4.6 Teachers needed to control student access to materials

It was important for teachers to be able to control whether and when students could obtain access to certain materials. The ability to do this depended on reliable login systems together with sophisticated control mechanisms allowing individual teachers to control access of individual students, or groups of students, to the online materials. Projects reported that the authentication systems available to them were restricting their usage of online learning as they could not carry out sufficiently fine-grained control of access to materials. Several projects had developed access systems, and were considering carrying out further work in this area.

4.5 USING COMPUTERS TO ENHANCE LEARNING MATERIALS

4.5.1 Use of animation to illustrate a process

Where a process involving movement was being described, multimedia computers could be used to present a moving diagram, or animation, to illustrate the process. For example the Consortium for the Provision of Digital Images on Demand, based at the CTI Centre for Land Use and Environmental Sciences (CLUES), used animation to illustrate various aspects of the flight of a starling, and the Click & Listen project developed animations to show movement of the soft palate while different sounds are produced. The Functional Anatomy and Biomechanics (FAB) project developed an animation to show how the distribution of tissues changes during the growth of a human bone. Another use of animation was to show the results of different inputs to a mathematical equation.

4.5.2 Use of hypertext links to present materials conveniently

Hypertext links were used to make it easier to cross-refer between different types of material. For example, the MAN Accessible Resource Based Learning Exemplars (MARBLE) consortium produced teaching materials for a course in environmental science; the module entitled 'Coastal Change in the Moray Firth' used a combination of maps and photographs on the ground to introduce students to important geological features of the Ardesier Peninsula on the Moray Firth. Some of the maps shown on the computer screen had 'hotspots'; when a student clicked the computer mouse on a hotspot,

the appropriate photograph appeared showing the terrain at that point. A particular photograph was thus linked to a particular site on the map, and perhaps to a soil profile diagram, building a resource that enabled users to move easily between different types of material, and where information was presented more conveniently than would have been possible using paper based materials.

4.5.3 Video materials to demonstrate processes

Multimedia computers were able to show film clips associated with text; this meant that students could be given access to filmed material which they could replay at any time. This was useful before field trips, for example, so that students knew what they were looking for, and useful afterwards because they could review what had been seen. The Consortium for the Provision of Digital Images on Demand used a video clip showing barnacles feeding under water, which demonstrated a process that was difficult to see in the field.

In a different module, the same consortium included a film clip of children interacting with each other, to illustrate particular aspects of child behaviour. This made it possible for medical students to view interactions which had been carefully selected to contain examples which might be difficult to catch in a clinical situation; the interactions were filmed at leisure in the presence of the parents so that the children were at ease and were not intimidated in any way. In another module, the consortium used film clips of medical diagnostic materials, in this case a film of an ultrasound scan, with explanatory text and annotations.

4.5.4 Substitute for socially problematic procedures

Another use of film material was to allow students to view procedures which they would prefer not to carry out themselves. A film of the dissection of a guinea pig had been used in this way at the University of Aberdeen for some time; this was made available via the web and was then more conveniently accessible to students, who could use it as often as necessary.

4.5.5 Use of simulation programs

Another opportunity provided by the use of multimedia computers in teaching was to provide simulation programs to enable students to explore processes. The OMNIBUS project developed simulations of the delivery of blood from refrigerated blood banks to use on the ward. These enabled students to practice managing the operation of these systems, and to explore the implications of different decisions.

4.5.6 Aural examples to accompany written text

Just as video could be used to demonstrate processes which involved movement, the capability of multimedia computers to generate sounds and to play recordings over the network was used to illustrate teaching examples.

The Click & Listen project developed material for speech therapy students; students could listen to the pronunciation of different words while seeing the phonetic symbols on screen, and found this a novel and easy way of learning the phonetic system. A further development was to record words and phrases spoken in different Scottish accents, so that therapists could learn what to expect to hear from patients in different parts of the country; the computer could generate words to be used during treatment which reflected the vocabulary and accent of the patient.

The consortium of HEI music departments (NETMUSE) developed materials for music students and made them available in two forms, either over an ‘ordinary’ Internet connection, or via a reserved-bandwidth connection. The reserved-bandwidth connection made use of the MAN Asynchronous Transfer Mode (ATM) technology and delivered hi-fi quality sound, making it possible for students to discriminate between very fine sound gradations. One of the NETMUSE packages allowed students to listen to the same piece of music played with instruments tuned to alternative systems, and to compare the results. This was an exciting innovation which contributed significantly to teaching in this field.

The project Providing Ethnological Archives for Research and Learning (PEARL) provided access to recorded materials in the archives of the School of Scottish Studies at the University of Edinburgh. Streaming audio was used, in which the file containing the music was played as soon as it was received; this avoided copyright problems, since the receiving computers did not need to make a copy of the music before playing it. The materials gave easy access to some of the School’s archive of historic recordings.

4.5.7 Making scarce resources available

Several projects made scarce resources available over the network. For example, the Macaulay Land Use Research Institute (MLURI) provided field trips to students from the University of Aberdeen, and had in the past provided each student with a series of soil maps relevant to particular trips. With increasing student numbers this was becoming impossible to do and so the maps were made available via the MAN; making them available in this way also meant that students and staff who wanted access to them did not have to travel to the MLURI, which is a few miles outside the city.

4.5.8 Scratching the surface

Several projects reported that there was potential and need to create many more materials than had been possible during the period of UMI funding. The FAB project wanted to extend its materials to cover different areas of anatomy; the PEARL project was only able to make available a small fraction of the archives of recordings held by the School of Scottish Studies at the University of Edinburgh.

4.6 DEVELOPING COURSES AND MATERIALS COLLABORATIVELY

4.6.1 Bartering to build on existing materials

The MANTCHI project held a meeting for teachers of human-computer interaction, at which different HEIs offered to contribute courseware for areas in which they were expert. ATOMs (Autonomous Teaching Object for MANTCHI) were then developed, as online modules each representing about eight hours of student time, including both contact-hours and study time.

Departments thus carried out further work on existing courses, and in return they gained access to high-quality materials in other areas of the curriculum. While no department created materials from scratch, each collaborating department did gain access to materials that were new to them.

4.6.2 Curriculum review

Three of the projects carried out wide-scale consultation exercises in order to reach a consensus on the topics to be included in the courseware that they later developed.

The Child Health project worked with the Scottish Child Health Group, consisting of paediatricians from each of the Scottish teaching hospitals. A national curriculum had already been established by this group for first year teaching of medical students in child health; the Child Health Medi-CAL project selected diseases from the national curriculum and developed courseware for them. Paediatricians in the group undertook to provide data for a specific disease, to be used in constructing the 'model patient' courseware.

The Remote Sensing project held discussions with most of the Scottish HEI teachers of remote sensing to agree topics for inclusion in the course. The SUMSMAN project contacted all the mathematics departments in Scotland, to relate the topics covered by the courseware they were using to the topics covered in 'service mathematics' courses. They used the results to prioritise the development and dissemination of courseware modules. This meant that in these two areas, a curriculum was reviewed by several HEIs, and materials were developed which made it possible for individual HEIs to widen their curriculum if they felt this was appropriate.

4.6.3 Subject experts work with multimedia developers

Once the topics to be developed had been agreed on, the projects that developed multimedia courseware used subject experts who worked with project multimedia developers to specify and produce the courseware. The subject experts were dispersed at different HEIs and collaborated with the developers by email, shared whiteboards, and video-conferencing, as well as face-to-face meetings. In many cases the multimedia specialists were themselves subject experts and this was thought to be important and to contribute to the quality of the materials. The Finesse project maintained two websites – a development site and a production site. The production site was used to hold materials that had been thoroughly tested and deemed stable.

The Child Health project development team produced a template which clinicians could use to develop scripts for their model patients. The completed scripts were then sent to the central team who created multimedia materials from them. The template provided a simple way to specify diagrams, particular question types, and particular models of interactivity, together with text content.

4.6.4 Wide mix of skills must be available within each team

The CVU noted that a very wide range of skills was needed, and that it was important for all the skills to be available within the project team. It also noted that division of labour within the team was important, and could take time to develop. The teams all needed expertise in Java programming, creating cgi scripts and web administration. Evaluation experts were employed, sometimes as team members, sometimes as external consultants. The Remote Sensing project developed website management tools.

4.6.5 Liaising with subject experts

The Child Health project employed a co-ordinator whose task was to liaise with subject experts and to encourage them to deliver scripts; they felt that this was an important role within the team, and that they would seek to maintain such a role in any future teams. Most subject experts underestimated the work involved in providing materials for the projects, and projects needed to spend appreciable amounts of time ensuring that their contributions were received. All teams reported that a lot of time was needed to liaise with contributors, and that site visits were often needed. It was important to demonstrate early on the real benefit that was likely to result from their work.

4.6.6 Rewarding contributors

The Remote Sensing project found that promises to contribute were not always kept. The team felt that in future it would plan to reward contributors, perhaps to budget next time to pay them an honorarium which

they felt would provide both reward, incentive and also a sense of obligation.

4.6.7 Expert contributors suggest pedagogic approach

The expert contributors to the Child Health project were encouraged to suggest design ideas and pedagogic approaches that could be used in the materials. The design team had a policy of adopting these suggestions wherever possible.

4.6.8 Systems developers sometimes lead with innovations

The technical evaluator for the Finesse project pointed out that systems developers will sometimes be able to lead with innovations, since subject experts will not always appreciate what computers can do for them. Teachers and other subject experts can then evaluate the potential of technical innovations and suggest further development and refinement.

4.6.9 Patient consent form

The Child Health project developed a patient consent form that was specifically for use in obtaining consent of patients whose images would be used as part of the teaching materials. Care was taken that patients would not be recognisable in the materials developed, but nevertheless consent for non-recognisable images to be used as part of teaching materials needed to be explicitly given.

4.7 RE-USING ONLINE COURSEWARE

4.7.1 Materials for use in a range of courses

Multimedia materials were expensive to develop, and expensive to modify; one approach to maximising usefulness was to build materials that could be used as part of several courses. For example the Click & Listen project materials used by speech therapists were also used for teaching drama students about particular accents. The materials created by the FAB project were used by students of medicine, nursing, physiotherapy and physical education.

4.7.2 Enable teachers to 'pick and mix'

The Remote Sensing team developed a range of quite small modules, each of which was intended to be used as stand-alone material. This meant that teachers could select individual modules, without having to use all of the materials, and use them to construct a course that was tailored to their liking.

4.7.3 Separate content from layout and navigation

The Remote Sensing project developed a system where the layout of web pages could be defined and changed independently from the content. This made it possible for teachers to change the appearance of the materials to fit in with their own style of teaching, and perhaps with other materials in use at the time. Fonts, paragraph style, navigation style and method of presenting self-assessment questions could all be defined separately. The materials could be translated easily into different languages.

4.7.4 Categorise and index online materials

The Remote Sensing project reported that if materials were to be re-used by others, they needed to be categorised and indexed. They recommended using a standard such as the Instructional Management System (IMS), creating metadata which would enable other teachers to assess what was available, and whether it would be useful to them.

4.7.5 Overcoming 'not invented here'

It was found that if all members of a consortium had contributed to the design of materials, and had contributed some content, they were more willing to use materials developed by others. Also having had the experience of contributing, they were more receptive to the idea of using the materials developed by others. This effect was very marked in the MANTCHI project which held bartering sessions where all attendees agreed to contribute something. The MANTCHI model also meant that all sites contributed some teaching effort, and all received some help with their teaching.

The Child Health project worked with the Scottish Child Health Group of Paediatricians, who are involved in teaching medical students. The group had already agreed a list of topics to form a national curriculum and the project facilitated the development of materials which created a collective resource that all were committed to using.

4.7.6 'Stamp of quality' for online materials

The Scottish Child Health Group intended to review the materials that were developed by the Child Health Medi-CAL project, and to maintain a web page in which the group stated that the materials developed by this project were considered by the Group to be good teaching materials. It seemed possible that other consortia might be able to provide similar statements of quality for their courseware.

4.7.7 Java applets

The Child Health project created Java applets which were available for re-use by future projects. These included applets which enabled easy implementation of different user interfaces such as 'select an item and put it into the shopping basket' etc. The Remote Sensing project created Java-based virtual laboratories with image processing tools. These were made available to the Scottish HE community for wider uptake and use. The Remote Sensing and CVU projects created communications tools for use in online learning environments. The Finesse project developed network-based groupware.

4.8 THE ADVANTAGES OF USING MANS TO DELIVER TEACHING MATERIALS

Computer-based materials can be delivered on stand-alone computers, either downloading software to the computer hard disk, or using CD-ROM drives. However, making materials available on the web, via the high speed connectivity of the MANs, conferred additional benefits.

4.8.1 Web-based materials were accessible to students anywhere in Scotland

Since UMI materials were all designed for access from the web, they could be accessed equally easily from any location with a high-speed connection to the Scottish HE MAN system.

4.8.2 The latest version was always available online

Since the materials were available via the network, there was no need to circulate CD-ROMs. When a new version of materials was developed, it was instantly available to all potential users. Additionally, students did not have to carry a CD-ROM with them, since the material was always ready for use on the web.

4.8.3 A single server could be used by different HEIs

Several projects made their materials available on only one server, and the materials were then accessed by students at different HEIs in Scotland.

4.8.4 MAN-based materials were used in teaching sessions

The MAN system was found to be sufficiently reliable to enable web-based materials to be used during teaching sessions. The materials could be accessed so quickly that users were unaware of the fairly long distances across which their materials were being retrieved. The UMI Co-ordinator was sufficiently confident in the system to give high-profile presentations illustrated with online materials used directly across the web.

4.8.5 Intranet support for distributed learners

The Glasgow hospitals provided information over the ClydeNET MAN to support medical students pursuing the new problem-based medical curriculum. Teaching materials, timetables, information about discussion-group sessions, and seminars were all made available using the network. Under the new curriculum, no two students needed to follow the same timetable or course of study, so timely provision of information was crucial to the success of this new learning model.

4.9 ISSUES OF USING MANS TO DELIVER TEACHING MATERIALS

Alongside the advantages of using MANs for teaching, it was found that there were some aspects of MAN delivery where caution was needed.

4.9.1 Students had to be online in order to use the materials

CD-ROMs could be more flexible than network-based materials, in that they could be used in locations where there was no network. Projects pointed out that while network access was fine for campus-based students, students in remote locations would need to buy and set up communications equipment such as a modem and Internet account, and using the materials would for them involve a telephone call and its associated charges.

4.9.2 Materials were best viewed from a direct MAN connection

The very fast connectivity provided by the advanced MAN technology encouraged the development of materials that depended on a high-speed connection in order to be effective. Hence, the materials were best viewed from computers that were directly connected to the MAN system.

4.9.3 Some materials were designed to use a direct ATM connection

The NETMUSE materials were designed for use with a direct ATM link. Although they were also available over ‘normal’ links, the high-quality audio needed for music appreciation and interpretation was only obtained using special equipment connected directly to ATM. This was a limitation since some departments had difficulty providing enough workstations with a direct link to ATM. As network technology improves, this limitation may disappear, but in the meantime some project members felt that such materials might be more usefully provided on CD-ROM. There were plans to copy some of the NETMUSE materials onto CD-ROM so that more groups could make use of them.

4.9.4 Servers needed maintenance

The web servers on which the materials were stored needed to be looked after by technical staff, and at the end of some projects such staff were no longer available. Servers sited in service departments tended to continue to be available, while servers maintained by project staff were sometimes no longer available after the end of the project. The materials themselves needed a little maintenance, for example when browsers changed, or when hypertext links became out of date. Sometimes it was necessary to adjust the access permissions to materials and this required technical intervention.

4.9.5 Vulnerability of online materials

When materials were stored on CD-ROM, individual CD-ROMs continued to be available and to work for the short-term foreseeable future. Materials made available via a network server could quite suddenly become completely inaccessible once the server ceased to be maintained. This happened to the materials developed by some projects. Materials stored only on servers could in the worst case be completely lost if steps were not taken to provide long-term archive storage for them; the materials developed by one project became unusable when the server on which they were mounted was moved to a new location. The project's technical staff member was no longer available to work on the server or the materials so it was not known when or if the materials would be available once again.

The Remote Sensing project used a system of dual servers, so that even if one server failed, the system would still be available on the other.

4.9.6 Teachers needed to know that servers would be available when they needed them

If materials were to be used in live teaching sessions, teachers needed to know that the server would be available for their use at all times. It was important that if there was a problem ten minutes before a class session, technical staff would be available to sort it out. Where materials were used by teachers at different HEIs, teachers from all the HEIs needed to know that the support staff maintaining the servers would provide that level of response. Lack of such reassurance was for one project a deterrent to further use of the materials.

4.9.7 Version control

Web-based teaching materials were likely to be in use by many people over any given period, so it was important that they were not updated too frequently or without consultation. Projects were tempted to continue to improve and update teaching materials held on the web, but this was frustrating for teachers and students who were basing their discussions on a particular version. It was found to be necessary to identify different versions of publicly available materials, and to maintain preceding versions online, so that teachers could choose when to start using a new version.

4.9.8 Copyright complications

As the potential for access increased, the problems of copyright also increased.

Many of the teaching materials used resources that were protected by copyright. Projects carried out copyright negotiations separately and as a result different projects provided different levels of access to their materials.

The negotiations carried out by the NETMUSE project meant that only the five HEIs in Scotland which currently provided music degrees could use these materials. If another HEI wished to provide access to these materials for its students, further negotiations would be needed. Some of the other projects were able to negotiate access to limited amounts of copyright material for all users in Scottish HE.

The copyright of images was found to be more complex than for plain text: the law was different, and precedents were different.

4.9.9 Teaching environments required authentication systems

Many of the teaching materials incorporated tracking of student activity, enabling the tutor to monitor student progress and to intervene if necessary; some of the teaching software triggered email messages to alert tutors when intervention might be needed. Computer-aided assessments were normally built into the teaching environments. These systems therefore needed to make use of a secure login system, so that teachers and students could rely on the information they received. There were other reasons why login systems were sometimes needed, for example copyright sometimes meant it was necessary to limit access to materials.

All of the UMI projects that developed such environments also developed their own authentication systems, and reported that though they were coping, increasing student numbers meant that their authentication systems were not yet powerful or robust enough to cope with the increasingly large number of students that they planned would eventually use these systems. Also, at a practical level, administration of student accounts became a time-consuming activity, as for example passwords were forgotten, but could not be replaced without appropriate security checks. Individual projects did not have the resources to administer this, and hence one project simply issued a new identification number and password to students who had lost their existing one.

4.9.10 Local network limitations

It was felt that while the wide area networks (MANs) provided adequate bandwidth, bottlenecks which limited response time or which caused equipment failure were usually in local campus networks. MANTCHI students reported that unreliability of computer hardware limited their learning activities.

The local networks at some HEIs were reported by the SUMSMAN project to deliver slow response times, causing packages to perform more slowly than was the case elsewhere. This was a limitation to usage of the SUMSMAN system. The Finesse project reported that the component of response time for

serving material over the MAN was less than one second. Delays larger than this were likely to be caused by local network problems.

4.9.11 Downloading materials to a local server

The SUMSMAN project promulgated the use of software which was made available on a central server, but which needed to be downloaded to a local network server for use. The project reported that the process of downloading and mounting on a local server proved a limitation to its use, since not all HEIs possessed servers suitable to receive the material. They also reported that the staff time needed to download the software was not always available, and the rules in some HEIs' public labs did not allow external material to be mounted. Consortia who shared materials which were stored on a web server did not face these difficulties.

4.10 ISSUES TO DO WITH CONSORTIA

While collaborative projects were declared to be successful by all the participants, some issues emerged and are listed below.

4.10.1 Access to server and its materials at the end of the project

Where more than one HEI shared a server for the duration of a development project, there might not be a suitable server where the materials could physically reside after project funding had ended. If the host institution did not want to use the materials in teaching after the end of the project, and thus did not make the materials readily available in the long term, the collaborating institutions needed to find hardware and staff to maintain the materials. This was not always possible and hence some materials became less easily available and had no maintenance support after the end of the project.

In one case, the materials produced formed a key part of the courses to be taught at an HEI, but there was no expertise available in-house to maintain them: the expertise to develop them had been procured as part of the project, and the hardware that was bought for the project was now in the ownership of a different HEI. This made it risky for staff to build the materials too closely into future course plans, since in teaching sessions it was imperative that all materials must be instantly available when needed. A server at a different HEI would be maintained by staff who were not normally required to deliver services to staff outside their institution.

4.10.2 Long-term maintenance of materials

At the end of projects, materials held on servers needed some technical maintenance if they were to remain available. If not all members of a consortium wished to continue using materials, the materials sometimes needed to be moved to a new server for continued use and maintenance; such a server and associated expertise/resource was not available at all HEIs and hence continued maintenance and availability was not always possible.

4.10.3 Copyright of materials developed jointly

The copyright of jointly produced materials was reported to be hard to establish. For example with recorded materials, one person might have developed the content; another person might have broadcast it over a communal network; another might (with permission) have made a film of the broadcast. The copyright of the final product was then complex.

4.10.4 Ownership and use of specialised equipment at end of funding

Equipment that had been obtained for project development reverted to the ownership of one HEI in each consortium when the projects ended. This meant that other project partners were not always able to carry out further development after the end of the project. Examples of such equipment included the specialised audio recording equipment used by the Click & Listen project.

5 Uptake of learning materials

During Spring 1997 most of the UMI Phase 1, Strand 2 projects were visited by the UMI Co-ordinator. In Autumn 1997 survey forms were sent out to the UMI Phase 1, Strand 2 projects that had produced teaching materials. Survey forms were sent to 12 projects, three of these being consortia who had each produced a variety of teaching materials on different topics. One consortium failed to return the survey forms. Several of the non-consortium projects produced three or four resources in related topics. In all the projects were able to report on 70 teaching resources.

The survey questions asked about the success and uptake of the materials in taught courses, evaluation of the materials, and use of the materials in other HEIs. The questions and a summary of the responses are shown in Appendix C. The individual survey returns can be made available separately.

5.1 USE IN TEACHING

Thirty-six of the resources were reported to be in use as part of taught courses, and 12 formed 'required' study material in at least one course. Fourteen resources were reported to be in use in more than one HEI. Not all resources were scheduled for use in future years; the survey acted as a reminder at one site that new staff needed to be made aware of what was available.

5.1.1 Number of students using the materials

Respondents found it difficult to estimate how many students were using the materials; numbers quoted ranged from 'a small number', to 30+, and up to 825 students using the Glasgow University FAB materials. Totalling all the responses, 2,885 students were thought at that time to be using materials created as part of UMI, but this was thought likely to be an underestimate.

5.1.2 Problems in using the materials

Problems in teaching were reported to be local network problems (four), and insufficient PCs or workstations for student use (six).

5.2 EVALUATION

Most projects had carried out developmental evaluation of the materials, and some had carried out informal assessment of their use during course work. Six projects reported plans to assess the value of the materials during future taught courses; they would welcome funding to assist such evaluation.

5.3 FURTHER DEVELOPMENTS

Some resources were being used as the basis for further developments; eight were part of UMI Phase 2 projects, and three were 'on hold' awaiting more development. Many project leaders were keen to continue developing the work that had been started.

Most of the projects reported that UMI funding fostered collaboration that would not otherwise have taken place.

6 Videoconferencing

6.1 BACKGROUND

Many of the proposals received by SHEFC for work in the UMI programme involved use of videoconferencing, and in response SHEFC offered funding to all Scottish HEIs to develop and install videoconference rooms. Nearly all HEIs accepted. During 1997 further funds were made available for the installation of a second videoconference room at each HEI, to be used for teaching.

Where possible the rooms were based on ATM technology, but a small number of sites were not directly connected to the ATM network and hence installed Integrated Services Digital Network (ISDN)-based videoconference rooms.

UMI-funded Videoconference rooms at Scottish HEIs.

University of Aberdeen	2
University of Abertay Dundee	1
University of Dundee	2
University of Edinburgh	2
Glasgow Caledonian University	2
University of Glasgow	2
Heriot-Watt University	2 + Talisman
Moray House Institute of Education	ISDN6
Napier University	3
Northern College of Education	2
University of Paisley	1 + 1 ISDN6
Queen Margaret College	2
The Robert Gordon University	1
Royal Scottish Academy of Music and Drama	1
The Scottish College of Textiles	ISDN6
St Andrews College	ISDN6
University of St Andrews	2
University of Stirling	2
University of Strathclyde	2

6.2 MANAGED VIDEOCONFERENCE NETWORK

The videoconference facilities were set up as a managed network, operated by a Videoconference Management Centre under contract to the UK Education and Research Network Association (UKERNA) and sited at the University of Edinburgh Computing Services (EUCS). The managed network of videoconference rooms was referred to as the Scottish MANs VideoConference Network (SMVCN). During 1996-1997 it was possible for up to 8 SMVCN rooms to take part in a multi-site conference, but this limit increased to 24 sites during 1998.

The SMVCN had an ISDN gateway and a gateway to Mbone (Multicast) videoconference technology, so that conferences could be held using a mixture of ATM, ISDN and Mbone technologies.

6.2.1 Booking system

The videoconference rooms were bookable through the management centre, and one of the functions of the centre was to ensure that any particular conference was technically possible before accepting the booking. Reasons for rejecting bookings included unavailability of bandwidth, and limits to the number of simultaneous multi-site conferences. A videoconference Booking Contact was identified at each HEI, who took responsibility for receiving bookings from staff for their local studios, and liaising with the management centre on all matters to do with the booking.

6.2.2 Quality checks

The management centre carried out quality checks to make sure that the videoconference facilities at each site were ready for use and in particular that the audio levels were correctly set. Conference participants were not able to alter the audio levels, since this would have interfered with the levels at other studios in a conference. Only rooms that had passed the quality checks were allowed to take part in conferences. As a result, the rooms could be booked and used at short notice, and users of the rooms did not need to know how to set them up.

6.2.3 Free at point of use

Most of the videoconference studios communicated entirely over the ATM network, with no need to use telephone lines. Use of these studios was therefore completely free of charge to the conference organisers and participants. The few studios that were based on ISDN technology made use of telephone lines and hence conference organisers had to make sure that the telephone costs would be paid. An ISDN6 connection incurred a cost of 6 simultaneous telephone calls for the duration of each conference.

Where conferences involved a mixture of ATM and ISDN studios, ISDN studios dialled in to the ISDN gateway at the management centre, and needed to pay the usual ISDN phone bill to do this.

6.2.4 Meetings of SMVCN contacts

The managers of the videoconference studios met approximately three-monthly, by videoconference, to discuss technical arrangements and user issues associated with the studios. Issues discussed included status of equipment installation, planning and operating the booking system, how to train users of the rooms, how to raise awareness of the existence of the rooms, user documentation for the rooms, and issues such as whether bookings could be accepted from staff members of different HEIs.

6.3 FACILITIES IN THE STUDIOS

When setting up the SMVCN, SHEFC contracted UKERNA, in consultation with the SMVCN managers, to develop a minimum hardware configuration to which all HEIs accepting funding had to conform. However, so long as this minimum was achieved, HEIs were free to design and provision their studios as they saw fit. As a result the facilities in each studio varied slightly but were compatible and provided an agreed functionality.

6.3.1 Studio controls

A small set of controls were available in each room, and most participants found that they could learn how to operate the controls after a few minutes practice. Some studios gave users very little control, while others allowed the conference chairman to pan cameras and select which views would be broadcast; users found that this took a little practice to do effectively.

6.3.2 Cameras, microphones and monitors

Delegates using the videoconference rooms saw two monitors, one showing a remote site, and one showing the image being broadcast from their own studio. The video switched automatically to show the latest site from which a speaker had contributed for 3 seconds continuously, hence short interjections or murmurs of support were possible without the video switching. All sites would see the current speaker, except for the site currently on air which would see the previous speaker. Mute buttons were available in most rooms, and these were very useful both to enable local discussion and to prevent too much switching of the video signal when many sites were online. Use of mute buttons became standard practice during large conferences.

Cameras were normally positioned above the monitor which showed the incoming picture, so that if participants looked at the image of a remote site while speaking, their own image on camera gave the impression of speaking directly to the other sites. In the Paisley studio a speaker could move about during a conference, facing the rest of the participants if required, and the camera would track the speaker if he or she moved while talking.

All rooms had a visualiser which enabled participants to show objects, pictures or fairly large sized text to delegates via the monitor at the other studios. The Paisley studio was designed with a 'teaching wall' which could be used as a projector screen.

6.3.3 High quality audio and video

The videoconference technology used in the rooms was provided by K-Net Ltd, and connected to the ATM network using Cellstack codecs. These provided 'mixed audio' in which sound from all sites in a conference could be heard simultaneously. This provided a level of ease of use not available in other videoconference systems, and allowed meetings to follow a more normal dynamic since it was much easier for participants to make short comments during a meeting, without the video switching to their site. The video was also of near-broadcast quality so that there was no jerkiness in the images, and participants could wear whatever clothes they liked without worrying about the effects of stripes or checks on the image.

6.4 USE OF THE VIDEOCONFERENCE FACILITIES

Information about use of the videoconference facilities was drawn from project reports, meetings chaired by the UMI co-ordinator for members of UMI projects, usage logs maintained by the management centre, and discussions at the SMVCN meetings.

UMI projects used the rooms for meetings, lectures, seminars and tutorials.

6.4.1 Save travel time for tutors; increase size of audience

The National Learning Network for Remote Sensing project reported that a teacher who had in previous years travelled to a different HEI to deliver a lecture series was now able to deliver it from the videoconference facility in his own institution. More students than before had been able to attend the lectures.

6.4.2 Students had access to a wider range of expertise

Several projects reported that their students valued the experience of speaking to experts from other HEIs during videoconference lectures and seminars. Both teachers and students felt that this enhanced the learning experience for the students concerned. The students at remote sites were most enthusiastic about videoconference sessions. The SUMSMAN project noted that the videoconference sessions enabled classes to run in a topic when too few students were wanting to take that topic at any one HEI.

6.4.3 Sharing data and slides during teaching sessions

Projects experimented with ways of making slides and web material available to other studios during videoconference sessions; this was referred to as ‘data-sharing’. Projects were keen for this facility to be available routinely in the videoconference rooms.

The Remote Sensing project held a series of videoconferenced tutorials in which they shared web-based material. Remote sites were able to take control of shared web pages and demonstrate use of the material. The MANTCHI project also held tutorials

in the ATM based videoconference rooms and evaluated their use.

6.4.4 Group sessions worked best

The SUMSMAN project reported that the optimum usage of the videoconference rooms in teaching was for groups of students to gather in a few sites. They could then obtain the benefit of access to remote experts and interact with students at other sites, but retain the benefit of informal discussions before and after the session with other students at the same site.

6.4.5 Local facilitator always needed

The MANTCHI project reported that a local facilitator was always needed in each videoconference location; however, the main burden of preparing and guiding the teaching session was borne by the expert for that session.

6.4.6 Recognition of faces

The MANTCHI project reported that the detail available on the videoconference room monitors was not sufficient to enable recognition of expressions on individual faces. This was a serious drawback when teaching since teachers could not gauge reactions as they would be able to do in a face-to-face meeting. During meetings, participants learned to give audible, murmured feedback, but students were not confident enough to do this.

6.4.7 Audio levels

The sound levels in the studios were set up by the Management Centre, and meeting participants were expected not to alter them. In most studios, there was no control available to participants to enable them to do this. Fairly low levels were set, and this sometimes made it difficult to hear what was said if local participants created competing sound, for example whispered conversations or a person leaving the room.

The Paisley studio hosted a performance by a string trio during the launch of the facilities, and the audio levels were felt to be too low for this to be really effective. Nevertheless the sound levels were successful during the large majority of meetings, and the rather low levels were not a disincentive to usage.

6.4.8 Minimal access surgery

An operating theatre at Ninewells Hospital and Medical school which was used for minimal access surgery (keyhole surgery) had equipment which could be connected to the videoconference network. Medical students were able to watch operations take place, and speak to the surgeon during the operation.

A pilot project demonstrated collaboration between computer science departments and medical departments, and indicated a further use of the videoconference facilities. Medical data was sent over the MAN from a hospital in one part of Edinburgh, to specialist computers in the University of Edinburgh Department of Computer Science where visualisation software was available. The data were displayed to surgeons who used the information to plan a successful operation. It was planned to provide this sort of facility using the videoconference rooms for viewing data.

6.4.9 Steering group meetings

The steering groups of most projects met approximately every three months, and several projects used the ATM-based videoconference rooms for part of the steering group meetings. For these meetings, no Scottish member of a steering group needed to travel more than about five miles in order to attend even though members were located at sites on all four MANs.

The Finesse project held monthly management meetings by videoconference, placing all agenda and minutes on the web; it also used Mbone videoconferencing using SUN workstations at Dundee and St Andrews. Members found the then lack of data-sharing facilities a hindrance to using the ATM studios for software development meetings.

6.4.10 Project management using videoconferencing

Several of the projects used the ATM-based videoconference rooms to hold regular team meetings and reported that the rooms worked well for this purpose. The Remote Sensing project, with members at each of three MANs, held a regular weekly meeting which all team members were expected to attend if possible. They reported that they were able to forget the technology and hold ‘normal’ team meetings and that as a result their dispersed team had been able to keep together in a way that would not otherwise have been possible. Videoconferencing had also enabled regular consultations between developers and subject experts.

6.4.11 Meetings for UMI project holders

Fortnightly videoconference meetings were held by the UMI Co-ordinator for all members of UMI projects; seven or eight sites were online at most meetings. It proved fairly easy to find guest speakers who were willing to attend these meetings by videoconference, either at one of the Scottish studios, or to connect to the SMVCN through its ISDN gateway.

6.4.12 Shorter meetings encouraged regular attendance

Since the videoconference rooms had to be booked for a definite length of time, meetings held in them could not overrun their time. This had benefits in making it possible for more steering group and other members to attend regularly since in addition to not needing to spend time travelling, they could be sure

that the meetings would be quite short and would finish on time. Meetings tended to be held a little more frequently, since travel was not involved, which in turn made it possible for each meeting to be fairly short.

6.4.13 Usage records

Logs of the booking information for the studios were maintained by the videoconference management centre, and these included an indication of the subject of the meetings. Statistics were compiled which indicated that usage of the rooms was increasing. To some extent this seemed likely to be due to the activities of a fairly restricted population of enthusiasts. It was noted that staff were more likely to use the videoconference facilities when they realised they did not have to pay to use them.

6.4.14 Rooms not always available

It was found towards the end of the UMI period that users wishing to book the videoconference facilities could no longer be sure of finding a time slot at the time they wished to use them. This provided a crude indication that their popularity was growing.

6.4.15 Access to the rooms

The videoconference rooms were installed at HEIs wherever space could be made available. The rooms were kept locked when not in use, since they contained valuable equipment, and were normally unlocked at the start of a booked conference by a member of technical staff. If no attendee appeared at any particular site, then the local site contact would have spent a significant amount of time opening up the studio and waiting for the attendee to arrive. It was agreed by the SMVCN managers that conference organisers would be required to obtain confirmation from at least one attendee for each site in a conference. This proved time-consuming and resulted in some potential attendees not getting access. The system remained a source of irritation throughout the Initiative. Access to the rooms by permanent reception staff or by porters would have made the system easier to use since they could more conveniently accommodate last minute requests.

6.4.16 A national facility?

The UMI Co-ordinator received a request from a member of lecturing staff who wanted to supervise students on placement by using the videoconference studios: a placement student could go to the HEI studio nearest to his or her placement, and speak to a supervisor who would be in the ‘home’ studio.

The issues raised were discussed by the SMVCN managers and included provision of support for users from outside an HEI, allowing users from different HEIs to book facilities, and insurance of outside users while on the premises of any particular HEI. It seemed that any change of practice in these areas would need to involve fairly high-level decision makers if the system was to operate as a national facility.

6.5 ROOM LAYOUT

Different studio layouts were installed at different HEIs, and as a result some experience was gained in which layouts worked best, and what features of studios were most important. If the layout and contents of studios had been too closely defined, this would have significantly restricted the knowledge of videoconferencing that has emerged in the Scottish HE community.

It was found that the layout of most rooms had disadvantages for use in teaching. In most of the rooms all the participants sat facing in one direction, so that they could all see the monitor with the incoming picture. This meant that conversations between participants in the room had to take place with participants facing the front, and speaking to each other via the monitor – that way all sites could join in the exchange. This technique could be accommodated during meetings, but for teaching purposes it was found to be difficult for the teacher not to be able to speak directly to his or her local audience.

6.5.1 Flexible layout versus stepped, fixed layout

Many of the videoconference rooms contained tables which were fixed onto stepped flooring. This meant that everyone in the room, sitting at the tables, could see the screens, but it also meant that the room layout could not easily be altered, and neither could the acoustics.

The University of Paisley opted to install a flexible layout in which the tables and chairs were arranged in a horseshoe pattern; the furniture could easily be moved and the carpets and curtains in the room could also be moved easily. This made it possible to use the room both for meetings and seminars, and to adjust the acoustics to make the room suitable for music performances if necessary.

6.5.2 Changing the room layout

Discussions were held by some projects to try to redesign some of the studios. Options discussed included installing extra cameras and microphones, so that teachers could face their local audience while still seeing the remote audience, and hence could easily address and hear both audiences.

There was discussion of the advantages of making attendees look sideways to see slides shown on the data-sharing projector: speakers from remote sites could see heads turning and thus know that their audience was paying attention, and could see their material!

6.5.3 Rooms too small

One of the UMI projects wished to increase its use of the studios in teaching, but found that the studio it wanted to use was too small to accommodate the number of students that were planned to attend. Several of the videoconference rooms seated around 6 people; many of the studios seated around 16 people. A few of the facilities were in full size lecture theatres.

6.6 TRAINING AND AWARENESS

As the videoconference facilities developed from a pilot project into an established service, the need for user support became apparent. Training, awareness and documentation were all needed. There was much discussion whether materials could be developed centrally, maybe by the TALiSMAN team, but a lot of site-specific information also needed to be made available. UKERNA took responsibility for developing a leaflet on videoconferencing, which it was felt might provide a skeleton to which local sites could add their own details.

The TALiSMAN project ran a series of videoconference road-shows to publicise the availability and potential of the videoconference network, and placed videoconference awareness materials on their website. Many HEIs held local awareness sessions and training events. Despite this many staff remained unaware of the new facilities. There was agreement within TALiSMAN and the SMVCN contacts that one way in which usage would grow was as individual staff members became members of committees who made use of the facilities.

6.7 DESKTOP VIDEOCONFERENCING

The TASCMAD project was set up to provide awareness to Scottish HE of the potential of videoconferencing provided across the Mbone. This technology was freely available, but TASCMAD discovered that many of the Scottish HEIs did not possess the hardware or technical expertise to make use of Mbone technology, nor were they likely to in the near future. The project concluded that for the next few years, Mbone technology would only be used in a fairly restricted number of HE locations.

6.7.1 Desktop videoconferencing tools for collaborative design teams

A project based at the University of Strathclyde used desktop videoconference software to enable students at different campuses to use shared workspaces in design education. Although the software was primitive compared with the versions available today, its use was seen as a success and a further project formed part of the Phase 2 CVU project.

6.7.2 Desktop videoconferencing in teaching laboratories

At the University of St Andrews, direct ATM connections were used for desktop videoconferencing projects; students working in a computer laboratory, using large screens, were each able to see a window on their screen containing the image of their tutor speaking to them, together with a window showing the tutor's computer, and a window showing their own work. Using headphones they were able to listen to the tutor, and could follow work in the tutor's window on their screens. The tutor in turn was able to examine the students' work. This was found to be successful and popular; the technology used was seen as expensive but similar technologies were becoming available at lower cost.

6.8 EXTRA BENEFITS TO THE HE COMMUNITY

Some benefits of UMI were not planned at the outset. These were mostly spin-offs of the activities of projects and of the Co-ordinator.

6.8.1 Seminar series now embedded in community life

The Remote Sensing project established a series of seminars for the remote sensing community in Scotland, and they reported that these had become a permanent part of that community's activities. Since the seminars were held using the ATM-based videoconference rooms they could be attended by members from all over Scotland.

The experiences of members of other projects resulted in other similar new uses of equipment and technology in areas not immediately linked to the projects themselves.

6.8.2 Steering group members became familiar with videoconferencing

Members of different steering groups reported that the project meetings had introduced them to videoconferencing and that they would be much more likely to use the videoconference rooms in future for other meetings. Had they not been invited to take part in specific meetings, they would have been unlikely to attend awareness events publicising the studios. Hence, the projects succeeded in reaching out to members of the HE community who were not part of the project teams themselves.

6.8.3 Community of project workers

The regular meetings and contacts facilitated by the UMI Co-ordinator created a community of project workers who were able to benefit from each other's work and to support each other during the life of the projects. Such collaborations seemed likely to continue after the end of the funding period.

6.8.4 Reaching staff outside UMI

The outside speakers who were invited to address the regular meetings of the UMI project holders enabled the UMI Co-ordinator to facilitate information exchange between the project members and the members of other HE programmes and initiatives. Project members commented that this was a valuable source of information about activities in the rest of the UK and beyond; staff who were not part of UMI were also welcome at the meetings, and some chose to attend as a way of keeping up to date.

7 Staff Development

7.1 NEED FOR BROAD-BRUSH AWARENESS

Discussions with project staff and with contacts at many levels in HEIs indicated that there was a big need to let academic staff know what was available and how they might use C&IT in teaching and learning. Technology was moving fast, and there was a continual need to keep staff informed.

7.1.1 Need for help in starting to use C&IT

Discussions indicated that many academic staff realised that they could use C&IT in teaching, even if they were not sure exactly how they might go about it. It was suggested that practical help, whether provided locally or by other means, was needed to complement awareness of pedagogic techniques and to help academics get the best out of their C&IT systems. Such help needed to be available at the time when individual staff members decide that they need it. The project CAL into Mainstream Teaching concluded that locally provided individual support was very successful for academic staff who want to start using C&IT in teaching.

7.1.2 Knowledge about materials after end of project

One response noted that the survey of teaching materials had reminded a department of the existence of the materials produced by a UMI project – a staff member had left and the materials were in danger of being forgotten about. This illustrated the need for a strategy to ensure continued maintenance and advertising of materials once they were developed.

Even where project staff remained in post, once funding came to an end it was not always clear that the resources would be available to make materials accessible for use in teaching. Not all projects had made arrangements to ensure that this would be the case.

7.1.3 Region-based web support?

The ClydeWeb Officer publicised web activities in the West of Scotland, and there was a lot of interest in the services that he provided. He held training courses, advised on website design, and designed a regional server which was available for use by all HEIs in ClydeNET. The MANTCHI project's website originated on this server, but, on the departure of the web support officer at the end of funding, the MANTCHI material was transferred to the UMI website. The web support officer was employed by the University of Glasgow Computing Services; the web server was operated by the Computing Services and hence was available after the end of the project. However the training and support functions ceased when the project's funding finished.

7.1.4 Awareness and training

By far the largest amount of funding for staff development was awarded to the TALiSMAN project. Several projects had a small element of staff development, and the BEGINternet project was wholly concerned with staff development.

The TALiSMAN project provided awareness days, specialist seminars, an online study centre, and consultancy services for videoconferencing, and it developed workbooks which were made available throughout Scottish HE. The TALiSMAN project was the subject of a separate evaluation. The BEGINternet project produced introductory materials aimed at helping staff who were new to computer networks to understand the potential of using MANs in teaching. The materials were made available in both paper-based and web-based form.

7.1.5 Finding and converting materials

The project CAL into Mainstream Teaching, based at the University of St Andrews, employed an education specialist to work with academic staff to help them identify materials available in their subject, and to create materials where appropriate. The project found that different departments had very different skill levels, and therefore created individualised training materials for staff. It hoped to re-use these in the future. Time-tabling constraints for teaching staff, and the importance of delivering training at the time of need, also meant that individual training was particularly effective. Staff were motivated to take part in the project when they needed to use technology in their teaching, but would not otherwise attend training courses.

This project's final report concluded that a long-term post was needed to carry on the work that had been started: ongoing support would be necessary to help staff to use the materials and to carry out further development or investigations. They were unable to predict how long the benefits would last in the absence of such a long-term post.

8 Planning technology provision

8.1 PHYSICAL INFRASTRUCTURE

8.1.1 Infrastructure differed between HEIs

The team of educational technologists in the Training And Support for Communication using Multimedia Applications from the Desktop (TASCMAD) project, who undertook to raise awareness of the possibilities of the Mbone, were surprised to find that at many Scottish HEIs this technology could not be supported. It was all too easy from a site that used the Mbone to forget that not all sites had the infrastructure and expertise to enable them to take advantage of this technology. Similarly, some HEIs had centrally available Unix servers on which teaching systems could be made available; at other HEIs such servers were not easily available. Staff at different HEIs had significantly different facilities at their disposal, and this needed to be remembered when planning central facilities and developments.

8.1.2 Predicting technology developments

Individual projects needed to know what technology developments were likely to become available during the life of their project. For example, some UMI projects wanted to use desktop videoconferencing and spent significant amounts of time trying to find out what was available, and what would soon be available. They were not able to plan their project activities until they had established what technology was available to them.

8.1.3 Advising network providers on what is needed

The network experts who were responsible for planning the development of the HEI network infrastructure were actively seeking direction on what would be required of their networks both to support learning and teaching and to support research. There was no group that had a remit to provide this sort of guidance.

8.2 SELECTING AND USING PUBLICLY FUNDED EQUIPMENT

8.2.1 Selecting equipment

During the course of UMI, additional equipment was funded by SHEFC for use in the videoconference studios. The process of deciding what equipment was needed revealed problems that were inherent in the type of choices that were involved.

The requirement for new facilities had been identified by teaching staff, some of whom had worked on UMI projects. Their recommendations were acted on by UKERNA's videoconference manager who co-ordinated the process of selecting equipment and making a case to SHEFC for funding it. However, while this process involved iterations between pedagogic demands and technical solutions, it was

not clear whether technologists or teachers should take responsibility for the final recommendation. This was a difficult problem since, while many teachers did not know what was possible, technologists did not necessarily know what teachers would need or how much importance should be placed on different aspects of technological provision.

8.3 TURNING PROJECTS INTO SERVICES

The IMPACT project established the feasibility of providing a low-cost parallel computing facility. Its leader however reported having difficulty finding funding to take the idea further, since he thought the next logical step would be to provide a service, and central funding was not typically available for that. He found it difficult to find support from other HEIs for a service that was not yet established.

This might indicate a general problem of finding funding for novel services which were not yet sufficiently well established to find support from the HE community.

9 Project selection and duration

9.1 ISSUES OF SHORT-TERM FUNDING

Phase 1 of UMI took place over a period of one academic year, and several projects had, for various reasons, a duration of funding of less than a year. Many of the Phase 1 projects wanted to comment on the problems of short-term funding.

9.1.1 Training project staff

Many of the projects employed staff to carry out project-specific tasks, and, as a result, a significant amount of the life of the project was spent in staff training: for example in the subject area of the project, or in computer-programming techniques. Where projects employed programming staff, these were usually postgraduate students who did not have experience in formal software development techniques. Accepted good practice (such as writing sustainable program code, and documenting program code so that it could be maintained over a long period) was not always understood by these staff, and hence had to be learned over the life of the project.

9.1.2 Experience lost at end of project

Without continuity of employment, experience built up during projects seemed likely to be lost. It seemed probable that succeeding projects would have to start with similarly inexperienced staff who would need to learn the same lessons.

9.1.3 Not enough time for evaluation

Most projects found that it was difficult to carry out meaningful evaluation of the project outcomes when the funded period was significantly less than one academic year. Where projects had developed materials for use in taught courses, unexpected delays sometimes meant that the materials were not ready at the appropriate time in the teaching year and hence could not be effectively tested during the project's life. After the end of funding, resources were not always available either to carry out evaluation, or to adapt the materials as a result of evaluation. Not all projects had budgeted sufficient funds or other resources for this purpose.

9.1.4 Effective teams disbanded at end of funding

Many teams reported that developing multimedia teaching materials was a time-consuming process, but that the teams became much more efficient as time went by and they gained experience in the processes involved. Hence longer-term projects were thought to offer better value since proportionately less of the project's life would be spent building a team and developing expertise. Many projects reported that by the end of the funding period, they had built up an enthusiastic team which was working well and productively. As funding came to an end the teams had to be disbanded just as they were becoming most productive.

9.1.5 Problems of retaining experienced technology developers

Several projects employed educational technology developers who were mostly young postgraduates or post-doctoral staff who were expert, or willing to become expert, in one or more aspects of IT such as Java programming, cgi scripting, video capture, and web server development. This was a wide specification and these staff were highly valued by the projects who employed them. They normally had good employment prospects outside HE, once these skills had been acquired. Some of the educational technology developers had teaching experience and experience of designing and authoring teaching materials.

It was felt that the career prospects for educational technology developers were not good within HE as compared with their prospects in the commercial world, and that unless suitable career structures for this sort of role were created within HE, HEIs and future projects would face the prospect of continually recruiting inexperienced staff, training them, and then losing them.

9.1.6 Exit strategies

Some projects had well-developed exit strategies, and planned to continue working after the end of funding. In other cases no exit strategy was evident apart from seeking further funding. The absence of such exit strategies meant that the achievements of some projects were in danger of being lost once the period of funding had ended.

9.2 UTILITIES

Two projects developed utilities, one aimed at making it easier to obtain and use teaching software, another to provide an index to Scottish websites.

9.2.1 Index of Scottish websites

The IDIOMS project at Heriot-Watt University developed an index of Scottish University websites. The index was well-presented, robust and widely used. However, it was not as useful as it could have been, since it drew its information from only those web servers that were using a particular indexing technology. Part of the work of this project was to persuade HEI web server administrators to use a particular indexing tool: however many web administrators decided that the software recommended was too difficult for them to implement and, as a result, their sites could not be included in the IDIOMS index. Hence the project produced an

index that provided only partial coverage of the HE websites in Scotland. The project was technically successful, but underestimated the support that sites would need if they were to adopt a different indexing technology.

9.2.2 Using TLTP software

The C-Web project provided information about software availability, particularly TLTP software, and aimed to develop software to make it easy for users to install TLTP software on their own hard disks, and to remove the software when it was no longer required. However, the project although technically successful did not fulfil its aims, since no TLTP project gave permission for the tool to be used. This provided a similar lesson to the one quoted in section 9.2.1; the effort needed to negotiate with other projects was underestimated and support for the work was not obtained at the start of the project.

9.3 SELECTION OF PROJECTS FOR FUNDING

As a result of the experiences gained during UMI, some lessons were learned about selection of projects for funding, and some questions were raised to which the answers were not always clear.

9.3.1 Appropriate use of the technology available

Since the aim of this initiative was to explore ways of using the MANs, appropriate use of the communications technology available was an important reason for the availability of funding. During the course of the initiative it became clear that simply using buzz-words in a project proposal did not mean that the project concerned would make appropriate use of technology, or that project leaders fully understood the potential of the systems at their disposal. It seemed that fuller investigation of project proposals, with requests for elaboration if needed, would help to avoid funding projects where use of technology was not central to the project's mission.

9.3.2 Funding technological development

Software systems developed by small teams sometimes had short life-spans, since the teams who produced them did not have the same level of resources as those available to commercial software houses. One UMI project lost time by trying to re-use software that had been developed by a previous centrally-funded HE project, only to find that the software was not robust and had to be abandoned.

It seemed desirable to devise ways of facilitating the wider uptake of future new software products; one possibility was to recommend that new software should conform to standards that would help to provide sustainability. Techniques were available to do this, and consultants could provide reports to advise on what was needed.

9.3.3 Developing facilities for use by other HEIs

Where projects set out to make facilities available to other projects, or to develop systems for and persuade other projects or sites to adopt and use certain strategies, it was thought with hindsight that there should have been demonstration of support for the strategies chosen before releasing funding. This might have avoided the problems reported in 9.2.1 and 9.2.2, and ensured that new projects recognised the importance of management and negotiation skills, as well as the technical feasibility of the proposals.

10 Evaluation

There was a lot of variability in the methods and thoroughness of the projects' evaluation activities.

10.1 EVALUATION OF COURSEWARE

10.1.1 Materials under development

All projects carried out formative evaluation of their systems during development. The Remote Sensing project used evaluation instruments developed by the European Meteorological Education and Training (EuroMET) project. The Finesse project monitored the use of its system by using questionnaires, talking to users and analysing event records. The finance education content of the Finesse materials was evaluated by external experts, as was the software engineering component.

10.1.2 Materials as part of credit bearing courses

SUMSMAN carried out extensive evaluation of student and staff experiences of using the project materials and facilities by means of questionnaires, interviews and focus groups, and by looking at examination marks. The MANTCHI project used integrative evaluation to study the success of the materials as part of credit-bearing courses; it developed a cost–benefit analysis of remote collaborative tutorial teaching. The Finesse programme was subject to existing teaching quality controls since it formed part of accredited degree programmes.

10.1.3 Experiences of teachers and students evaluated separately

The MANTCHI project felt that it should have spent more time evaluating teachers' experiences as well as those of students. It felt that the main gains of the project were in staff development, and that different evaluation methods needed to be developed and applied in order to study this properly.

10.2 EVALUATING SOFTWARE

The Finesse project used an external software engineering expert to comment on the technical quality of the software produced, suggesting possible improvements to make it more robust, efficient and maintainable.

10.3 EVALUATING USE OF THE VIDEOCONFERENCE FACILITIES

The SUMSMAN, MANTCHI and Remote Sensing projects carried out extensive evaluations of the use of the videoconference facilities in teaching. The Remote Sensing project evaluated a series of videoconference lectures and tutorials.

11 Work of the UMI Co-ordinator

The UMI Co-ordinator had a wide-ranging remit which included both monitoring and reporting, and supporting the work of UMI-funded projects. In addition, she was required to liaise with other initiatives, and to disseminate the outcomes and achievements of the initiative.

11.1 PROJECT MONITORING

11.1.1 Work with Phase 1 projects

The UMI Co-ordinator was appointed in November 1996, and at that time many of the first phase of UMI projects were coming to the end of their funded work; several had already completed.

The Co-ordinator requested a report from all of the Phase 1 projects in Strands 2 and 3 (Applications and Staff Development respectively). Having received the reports she followed up by visiting most of these projects. A survey was carried out in Autumn 1997–Spring 1998 to find out whether the online materials developed by UMI projects were in use, and whether evaluation of usage and uptake had been carried out or was planned. The major part of the Strand 3 element of UMI Phase 1 comprised the TALiSMAN project, and in May 1998 the Co-ordinator initiated an external evaluation of TALiSMAN. A separate evaluation report was produced.

11.1.2 Reporting

The Co-ordinator attended meetings of the UMI Steering Group and reported to the group and to SHEFC on issues raised by her work with projects and her other activities. In addition to this she reported regularly to Dr Paul Clark, the Director of Teaching and Learning at SHEFC.

11.1.3 Monitoring Phase 2 projects

The Co-ordinator obtained six-monthly reports from the six projects that were funded under Phase 2 of UMI, and reported on their progress to the UMI Steering Group. Each of the projects made a presentation to the UMI Steering Group in January 1998.

11.2 PROJECT SUPPORT

11.2.1 Regular meetings by videoconference

Fortnightly meetings were initiated by the Co-ordinator and held by videoconference for all members of UMI projects; seven or eight sites were online at most meetings. It proved fairly easy to find guest speakers who were willing to attend these meetings by videoconference, either at one of the Scottish studios, or to connect to the Scottish network through the ISDN gateway. Speakers covered a range of topics, including an introduction to the work of the IMS project, an overview of JISC JTAP activities, a discussion on the ATHENS authentication system and its relevance to UMI projects, a talk from the UK Web Focus Officer, a discussion on using metadata in web materials, and presentations and discussions with speakers from the SHEFC executive.

Each meeting lasted one hour, and started with a report from the Co-ordinator on her attendance at conferences and meetings; this report was used as an opportunity to update the projects as soon as possible on issues that might affect them. Each project was then given a chance to report to the meeting. Next, the guest speaker was invited to talk, usually for about 15 minutes, after which a lively debate and discussion normally took place.

Higher Education staff from outside UMI were welcome to attend these meetings, and several did so. The meetings became known as a regular opportunity to discuss other initiatives and their outcomes. Discussion at these meetings has led to collaboration between projects in order to address common problems: Finesse evaluated the use of ATHENS and made the results available to the other projects. All discussed IMS and its applicability to the UMI projects. The Child Health project agreed to pilot the use of the CVU assessment engine.

11.2.2 Collaboration between projects

The Co-ordinator provided a meeting for all members of UMI Phase 2 projects, in which members from different projects were able to meet and establish areas where collaboration could take place. It was possible to identify areas in which most projects were working, and where further workshops and collaboration between projects might be possible. The individual project members took the opportunity to start collaborations which continued during succeeding months.

11.2.3 Workshops and information for projects

Projects asked for information and support in the areas of: assessment tools; monitoring network performance; videoconferencing technology, how to choose it, how to use it; Java/cgi programming; copyright; access permissions; password protection; access to sensitive materials; authenticating users for assessment purposes; IEEE standards on educational technology; evaluation; software to help in scheduling group meetings; support of students using computer-based materials; ensuring that students take online materials seriously.

The Co-ordinator provided a workshop on evaluation, hosted a discussion day for projects' Java programmers, and used the fortnightly videoconference meetings to invite guest speakers

who were able to give information to projects about the other areas identified.

11.2.4 Mailbase discussion list

An email discussion list was set up at the Newcastle Mailbase facility. The list was called UMI-INFO and was used to circulate notices, to hold short discussions, to circulate items of interest to projects, and to circulate minutes of meetings.

11.2.5 UMI website

A website was established at http://www.use-of-mans.ac.uk/, and used to provide details of projects with links to projects' own websites. The project information was based on data held in an Access database, and regularly exported to the web server. The UMI website also stored information on videoconferencing, minutes of UMI meetings, and had links to related sites. Its address is http://www.use-of-mans.ac.uk/

11.3 MONITOR AND SUPPORT VIDEOCONFERENCE DEVELOPMENTS

11.3.1 SMVCN meetings

The UMI Co-ordinator attended the regular meetings of the Scottish MANs Videoconference Network (SMVCN), which was chaired by a representative of the UK Education and Research Network Association (UKERNA), since UKERNA was commissioned by the Joint Information System Committee (JISC) to manage the UK HE videoconference facilities. The UMI Co-ordinator provided feedback to the SMVCN group on project experiences with the videoconference facilities, and with the videoconference room booking procedures; she helped them to develop their proposal for submission to SHEFC to provide data-sharing equipment for the videoconference rooms (comprising for each studio a PC connected to the Internet, and a projector and screen or monitor). She used the UMI videoconference meetings to poll for user opinions which she relayed to the SMVCN group.

The Co-ordinator contributed to the specification of UKERNA's review of the videoconference facilities and worked with the Edinburgh videoconference management centre to specify which usage statistics were needed as part of the review.

11.3.2 Regular use of the videoconference rooms

The use of the videoconference rooms for UMI meetings proved a useful test-bed for trying out the booking procedures. The Co-ordinator wished to make block bookings of the rooms, and to book the rooms several weeks or months ahead, and the procedures for this were discussed at the SMVCN meetings. Problems were discussed and solutions found: for example if an attendee pulled out of a conference at the last minute, local site contacts needed to be informed since otherwise time was wasted opening up the studio and waiting for the attendee to arrive. Other possibilities such as use by staff from other HEIs of a particular HEI's studio were also pioneered by these conferences, and procedures agreed with the SMVCN group.

11.3.3 Videoconference launch event

The Scottish MANs Consultative Group (SMCG) and the SMVCN contacts requested the Co-ordinator to organise a launch event for the videoconference facilities, and this event was held in February 1998. The launch included a link to a keyhole surgery operation (with an opportunity to talk to the surgeon); demonstrations of videoconference and web-based teaching in mathematics, remote sensing and distance education; and a question-and-answer session when principals, vice-principals and other high-level attendees from the eight sites online were able to ask questions and provide answers about the facilities being launched.

11.4 DISSEMINATION

11.4.1 Conferences and other meetings

The Co-ordinator spoke at many events organised by TALiSMAN, both MAN awareness days and specialist seminars, and chaired sessions at TALiSMAN seminars. Together with TALiSMAN she held a series of dissemination events where the UMI Phase 2 projects were able to present their activities to the HE community in Scotland. She was invited to speak at events held by UMI projects including a NETMUSE event, a Committee Of Scottish Higher Education Principals (COSHEP) event for librarians, and addressed the COSHEP staff development group. She also spoke at international conferences.

11.4.2 Consulted by other MAN groups in the UK

The UMI Co-ordinator was invited to speak to external groups including the Further Education Glasgow Telecolleges network, the Welsh MAN consortium, and the JISC-ASSIST workshop on MANs.

11.5 LIAISON

11.5.1 Liaison with other initiatives

The Co-ordinator maintained contacts and attended regular meetings with representatives of other UK bodies including JISC and JISC-funded initiatives such as JTAP, eLib, and the Information Strategies Initiative, with teaching, learning and staff-development initiatives such as LTDI, TLTP, CTI and FDTL.

Liaison with other initiatives was found to be an important element of the Co-ordinator's job, since it enabled her to pass on information to the UMI projects about the aims and activities of other

projects in the UK and overseas. Information was exchanged in both directions, so that other UK initiatives were informed of the work being undertaken in UMI.

11.5.2 Liaison with C&IT managers

The Co-ordinator kept up to date with technical developments in UK HE networking, and was able to relay information about these to the UMI projects. Sources of information included meetings of the individual MAN management committees, the Scottish MANs Consultative Group (SMCG), and the Scottish MANs Videoconference Network (SMVCN).

11.5.3 Documenting research uses of the MANs

The Co-ordinator worked with the MAN management groups to find ways of documenting the usage of networks by research projects and other innovative network users.

Appendix A: Summary of UMI projects

PHASE 1 PROJECTS

Using The MANs: Strand 2 Projects

PICS (EaStMAN)
Psychological Image Collection at Stirling
An archive of images was set up for use in psychology research. Researchers in psychology and machine vision require carefully controlled sets of images, eg faces with uniform lighting and background. PICS held an archive of such collections of images, including faces, natural scenes, textures and children's drawings.

PEARL (EaStMAN)
Provision of Ethnological Archives for Research and Learning
World wide web and RealAudio® technologies provided access to selected articles from the journal 'Tocher', including real-time playback and control of the audio archive items from which the content of these articles was transcribed. The academic journal 'Scottish Studies', the magazine 'Tocher', and the cassette and CD series 'Scottish Tradition' (reflecting the contents of the tape archives) keep the School of Scottish Studies well known throughout the world. PEARL used web and RealAudio® technologies to provide access to selected articles from 'Tocher', including real-time playback and control of the audio archive item(s) from which the content of these articles was transcribed.

CLICK & LISTEN (EaStMAN)
Multimedia teaching materials including audio examples and Java-based animations for students of phonetics; used Scots and Scottish English. The project concentrated on the phonetics and phonology of Scots and Scottish English, the languages most widely spoken and written in Scotland today. The package provided users with access to a large database of speech recordings, covering basic phonetics, the sound structure of Scots and Scottish English, dialect samples, and examples of Scottish literature. The project was aimed at students of Scots and English language, speech and language therapy, drama, and those undergoing teacher training.

Arts Server (EaStMAN)
A web server was provided and used from three computer laboratories in Edinburgh College of Art. There were up to 20 workstations per laboratory, connected to the internal college network, the MAN, SuperJANET and the Internet. These facilities were used by students, researchers and staff for both class teaching and open access work.

OMNIBUS (EaStMAN)
A multimedia library for business studies. There was a significant overlap in the course content of the three business studies departments of the Universities of Edinburgh, Heriot-Watt and Napier, particularly in the early parts of degree schemes. A joint multimedia library facilitated the collaboration of these departments to provide more effective and efficient teaching and learning, and also gave the opportunity to reach a wider student audience. The facility was sited and managed from the University of Edinburgh. The term OMNIBUS was derived from the domain name of the host server omni.bus.ed.ac.uk

MARBLE (EaStMAN)
MAN Accessible Resource Based Learning Exemplars
Ten sub-projects developed multimedia teaching materials in a wide range of subject areas for delivery across the MAN. The MARBLE project developed resource-based learning materials on the web which stand as exemplars for staff who want to develop similar teaching resources. Some of the materials have been delivered to students as integral parts of courses at more than one university. A substantial body of material was developed and made available.

IMPACT (ClydeNET)
High Performance Parallel Computing using ClydeNET
A high-performance computing capability for the Universities of Glasgow and Strathclyde. The major objective of the project was to exploit the ClydeNET MAN to demonstrate the ability to create an affordable high-performance computing environment using low-cost workstations. Groups from the Universities of Glasgow and Strathclyde purchased equipment and software to provide a high-performance computing capability for both campuses, utilising existing and planned workstations. The approach was through the direct connection of workstation clusters on to the ClydeNET MAN using ATM technology.

Broadband Link with partner school (ClydeNET)
A microwave link allowed student teachers to be monitored and supported during their teaching placement. This ongoing project investigated the use of videoconferencing to liaise with a partner school over placement management, to support student teachers on school placements and to conduct in-service training of staff at a distance.

Medical MAN (ClydeNET)
Through this project, the focus of which was medical teaching, separate existing networks were linked which allowed wider accessibility of teaching/learning material to staff/students. Medical MAN linked microcomputer clusters in four teaching hospitals within the city of Glasgow with microcomputer clusters within the University of Glasgow, enabling medical students to access and use the network from any of these sites. A Clinical Medicine Planning Unit server was installed, connecting the Faculty of Medicine with the University network and so to Medical MAN, ClydeNET and the Internet. A study guide was developed for the new medical curriculum for session 1996/97.

FAB (ClydeNET)
Functional Anatomy and Biomechanics
Web collaboration between the four universities in the ClydeNET area. The project produced a series of web-based tutorials combined with a comprehensive glossary covering the anatomy and biomechanics of the human lower limb. It was hoped that in future it would be possible to extend this to cover other aspects of human form and function of relevance to the clinical and scientific communities. The project used film clips, animations, diagrams, self-assessment questions. The materials were suited to self-based and object-based learning, and could be used with a range of different courses.

Distance learning resources (ClydeNET)
The aim of this project was to provide wide access to distance learning resources and support. This project was intended to complement existing facilities so as to extend the support capacity and means of access to distance learning materials to students and academic staff. The new support environment allowed access to resources in the form of online learning materials, programme support, programme management, case databases, research methods and assessment methods. These resources were offered throughout the Paisley campus and to other institutions within the Metropolitan Area Network.

Co-working for course design and project supervision (ClydeNET)
Students of design, manufacture and engineering management used a shared whiteboard across the MAN to share ideas with students of design, manufacture and engineering management at another campus. A co-operative working environment was established between the Department of Design, Manufacture and Engineering Management on one campus and the Division of Design and Technology on another. Students used a shared workspace in a design exercise, and the shared workspace was used to augment a class in illustration and presentation.

NETMUSE: Net Based Music Education (ClydeNET)
Multimedia packages in support of HE music. NETMUSE formed from a consortium of all the degree-awarding music departments in Scotland to develop networked multimedia packages in support of HE music. Special features included CD quality audio-serving with streaming to the desktop and massive graphics.

Consortium for the Provision of Digital Images on Demand (AbMAN)
Based at CLUES (Centre for CBL in Land Use and Environmental Sciences). CAL materials in biological and environmental sciences, electronic and electrical engineering, and medicine and health care. A large body of teaching materials was developed and made available on a video-clip server. Applications included multimedia video-clip and still-image databases with supporting instructional text explaining procedures, processes, microscopic specimens and animal behaviour; a digital video interactive interview case study; computer-aided assessment multimedia question banks; and access to a remote image database.

Walmsley Collection of Human Embryo Slides (FaTMAN)
An extensive database of resources relating to human embryonic development. The Walmsley Collection at the University of St. Andrews' School of Biological and Medical Sciences consisted of 40 sectioned human embryos, ranging from 3mm (approx 27 days) to 50mm (nine weeks). The database allowed researchers to find out whether the collection contained specimens that would be of use to them. The Department also stored sections from the collection as high-resolution computer images which could be made available via the Internet to other researchers.

Computing provision for students (FaTMAN)
Cost-effective, network-distributed computing provision for students. This project provided significant improvements to access to computing facilities for students. A 40-seat computer cluster with 24-hour access was made available for use, and access to the local network and MAN-related services was improved. The project also allowed good progress to be made in tackling the problems surrounding the networking and support of computers in student study-bedrooms.

Advancing Computer Supported Learning through Broadband Technology (ACSL) (FaTMAN)
The joint aim of the two universities involved in this project, the Universities of St Andrews and Dundee, was to collaborate and share experience on the use of networked digital audio-visual technologies (AV) and the web in computer science education. As a

result of this project, AV seminars were delivered simultaneously to sites on either side of the River Tay, and a stable ATM teaching laboratory ran on a routine daily basis for scheduled student use.

Computer Based Learning for computing courses (FaTMAN)
Web-based materials were developed for teaching computer science courses. CBL packages were produced for applied computing courses, and ran on the web. The CBL material both augmented (in the sense that students used it at any time) and substituted (in the sense that one or two lectures per week were replaced with CBL) for parts of the courses. An extension of the CBL project to allow interactive tutoring from a remote site was planned for the future.

Tutor at a Distance (FaTMAN)
Students were able to communicate with a tutor using Mbone technology. The Department of Accountancy and Business Finance, Dundee University, and the Department of Management, St Andrews University, carried out an investigation into the ways that CAL/CBL could make more efficient use of staff resources. For example, through the use of CAL packages, tutorial sessions at Dundee University were monitored by a tutor in St Andrews who was able to respond in real-time to student queries.

Philosophy web server (FaTMAN)
Teaching materials for students of philosophy were authored and made available on the web. The development of an interactive web server application was proposed to support Philosophy Department teaching and to promote Philosophy Department liaison with, and recruitment from, neighbouring schools and further education colleges. The system enabled students to add questions and comments to web pages which were publicly available, and to engage in on-going discussions with lecturers. The system also formed a basis for distance learning.

Mathematics web server and hypertext tutorials (FaTMAN)
Mathematics tutorials were developed for the web; these included the facility to compile C programs on the web. This project developed hypertext pages of use to staff and students in mathematics-related subjects at Dundee, St Andrews and Abertay Universities. The main features of this project included a numerical analysis website and interactive tutorials for widely-used software packages (Matlab, Maple and LaTeX).

UTILITY PROJECTS

IDIOMS (EaStMAN)
Intelligent Discovery of Information On MANs in Scotland
HE web masters throughout Scotland were encouraged to index their sites using Harvest; the indexes were brought together and made available via HENSA. The IDIOMS project developed and disseminated software to support automatic, adaptive cataloguing, searching and notification about information resources and services on the Scottish MANs. A Harvest indexing service was set up for all 18 Scottish HEIs linked by the MANs. Resource-discovery software was further developed and disseminated to keep MAN users well informed about the information and services available.

C-Web (EaStMAN)
A Courseware Web
This project aimed to provide a service to the TLTP community by offering a WWW presence and by developing methods to deliver courseware. The C-web project supported the TLTP home pages, providing access to the catalogue of products and building a list of downloadable outputs from the programme. A method was developed for delivery and remote installation of some of the PC-based software; the method was demonstrated for two of the projects.

Web server provision (ClydeNET)
This project set up and maintained the Clydenet server which was available for use by all UMI projects in the Clydenet area.

Web cache server (FaTMAN)
A web caching server was established to enable more effective use of both local and JANET resources by storing commonly used web pages locally and thus delivering them faster. The additional advantage of this was a reduction in the amount of bandwidth consumed by web traffic. The main purpose of the cache was to service local requests, but co-operative links with other caches would provide more effective retrieval of web pages nationally and further reduce the load on international JANET connections.

Network management system (FaTMAN)
A network management system was installed for use by all members of the FaTMAN consortium. This project was a joint collaboration between the Universities of St Andrews, Dundee and Abertay Dundee, and Northern College (Dundee). As a result of this project, a common network management system was implemented which provided comprehensive management tools for the FaTMAN and for the members' campus networks. The network management software offered distributed network management with automatic fallback in the event of failure of the primary NMS server.

Common Helpdesk (FaTMAN)
A common helpdesk system was introduced which allowed the participating institutions (the Universities of Dundee [lead institution], Abertay Dundee and St Andrews) to make more effective use of support staff expertise, and facilitated the continuous improvement of the quality of end-user support.

STAFF DEVELOPMENT: Strand 3 Projects

TALiSMAN (EaStMAN)
Teaching And Learning in Scottish Metropolitan Area Networks
TALiSMAN developed and delivered a range of workshops, seminars and documentation to help the Scottish academic community use the MANs for Teaching and Learning. The TALiSMAN project provided a wide range of awareness events, training courses delivered both locally, by videoconference, and online courses, and specialist seminars. TALiSMAN had its own videoconference facilities which it used for training purposes.

Netware training (EaStMAN)
Training materials were developed for staff using Novell networks. Network training materials were produced in-house by adapting a core set of materials developed by the Network Training Initiative.

Training staff for distance tutoring (FaTMAN)
Materials were developed to train staff for computer-mediated distance learning. Staff training involved visits to TLTP dissemination sites including the Heriot-Watt University and De Montfort University.

TASCMAD (ClydeNET)
Training And Support for Communication using Multimedia Applications from the Desktop
Advice on Mbone videoconferencing, with demonstrations and discussion of potential, for users in the ClydeNET region. This project carried out awareness events and training days, explaining the potential for Mbone videoconferencing. Team members visited sites and investigated the problems that would be involved in setting up Mbone facilities.

BEGINternet (ClydeNET)
This project developed a paper based booklet and web-based materials explaining the potentials of the MANs for use in Teaching and Learning.

Using the philosophy web server (FaTMAN)
Staff were taught how to make use of the materials provided on the philosophy web server. It was necessary to train each full-time member of staff in the philosophy department in the relevant skills for maintaining and updating the new system. The staff were taught through seminars run by the developer of the system and also through IT services on the Internet.

CAL into Mainstream Teaching (FaTMAN)
Staff development initiative to enable the effective integration of learning technologies into teaching. Selected members of academic staff received training and access to some of the equipment needed to integrate learning technologies into their teaching. If schools and departments were to move forward in their use of learning technologies, they needed to rely for the most part on their own staff rather than external resources. A self-help group, the Web Teaching Forum, was formed to help staff learn (often from each other) how to effectively use these new tools and techniques.

PHASE 2 PROJECTS

SUMSMAN (EaStMAN)
Scottish Universities Maths and Statistics across the MANs
SUMSMAN provided a core curriculum for mathematics and statistics using computer materials developed under TLTP and other programmes, and also flexible learning study guides. The project aimed to exploit the potential of the MANs to offer an integrated learning programme comprising high-quality courseware developed under previously funded initiatives.

CVU (ClydeNET)
Clyde Virtual University
Internet-based multimedia learning materials were made available during UMI Phase 1, at a site presented as a Virtual University with a Lecture Hall, Virtual Café, Library, Assessment Hall and Administration Office. CVU delivered Internet-based multimedia learning materials to students at institutions connected to the ClydeNet MAN. CVU was a collaborative project between Strathclyde University (the lead institution), The University of Glasgow, Glasgow Caledonian University, Paisley University and Glasgow School of Art. CVU1 created a successful online educational environment. In Phase 2 of UMI, CVU2 extended these facilities to include videoconferencing and shared workspace technology.

FINESSE (FaTMAN)
Finance Education in a Scalable Software Environment
This project used a distributed learning environment for finance students, and developed a computer-based portfolio management game based on stock market data which were automatically updated daily. Mbone-based videoconferencing tools were used in conjunction with the specially developed spreadsheet software to provide a new way of teaching finance students.

MANTCHI (ClydeNET)
MAN-based Tutoring in Computer Human Interaction
The objectives of this project were to promote and develop collaborative task-based tutorial teaching of computer–human interaction over the MANs; to measure educational effectiveness; to develop and integrate tools for remote online tutorials; and to develop and validate principles. Departments in the Glasgow Caledonian University, the University of Glasgow, Heriot-Watt University and Napier University offered courses or parts of courses which were made available to students at all four universities.

Child Health Medi-CAL (AbMAN)
This project developed materials to deliver a core medical curriculum in paediatric medicine. Ten example patients were developed by a consortium of paediatricians from hospitals all over Scotland working with a team of multimedia developers.

National Learning Network for Remote Sensing (ClydeNET)
Web-based multimedia interactive courses in remote sensing were developed, and novel methods of teaching using videoconferencing were explored and evaluated. Remote sensing is taught as part of many degrees including geography, environmental sciences, engineering and physics, but teaching staff tended to work in isolation with relatively limited resources. This project aimed to overcome these problems and strengthen both the teaching and student communities in this subject, and share expertise and knowledge between institutions.

Appendix B: Teaching modules produced by UMI Phase 1 Projects

Consortium for the Provision of Digital Video Images on Demand
Animal Diversity
Nutrition and Digestion
General Vertebrate Taxonomy
Ecology
Blood Pressure Measurement
Cell Structure and Function
Clinical cases for the Internet
Consultation Case Study
Design Exercise
Digital Video Coding
Engineering Applications
Environmental Assessment
Fish Behaviour
Barnacle Feeding
Flight Thermograph
Baby Jack Case Study
Lasers
Dissection of the Lymphoid System of the Mouse
Mammal Distribution
Towards Maturity
Pathological and Anatomical Database
Flushing Rat Parasites
Consultation Case Study
Foetal Ultrasound Scan

CVU
Equal Opportunities
Employment Law
Personnel and Development
Employment Development
Organisational Behaviour
SN1 and SN2 Animations
Reinforced Concrete
Seismic Behaviour
Clinical Biochemistry Tutorials
Organisational Studies
UNIXhelp for Users
C Programming
Java Tutorial
CALF Fluid Dynamics
Advanced WWW Authoring Study Skills
Library Search Skills
Computer Sources
An Introduction to Non-Euclidean Geometry
De Tudo um Poco - Portuguese for Beginners
Optical Systems

OMNIBUS
Social Work and Information Technology
The Blood Transfusion Service Simulation
Course Chooser/Timetable Options
WWW Business Resources
Multimedia Library for Business Studies (Heriot Watt)
Multimedia Library for Business Studies (Napier)

Broadband Link with partner school
Broadband Computer Supported Collaborative Work (BCSCW)
Interactive Business Game
Intelligent Tutoring

FAB
Anatomy
Clinical
Biomechanics

NETMUSE
Contemporary Scottish Composers
Music In Britain from the beginnings to 1300
Darius Milhaud's La Creation du Monde
Co-working for Course Design
Facility for Collaborative Design Using Shared Workspaces

PEARL
Tocher
Gallery
Greentrax

Click & Listen
Vowel Recordings
Poetry Readings
Animations of soft palate

Maths Server and Hypertext Tutorials
WANDA

Philosophy Web Server
Tutorial Dialogue

MARBLE
Molecular Sequence Databases
Biological Sciences Databases
The WWW for Computing Courses
Computers in Teaching and Learning
Interactive Vision
Mathematical Assessment
The Built Environment
Geotechnical Engineering
Library Information Retrieval
Introduction to Psychology

St Andrews College
BEGINternet

Appendix C: Survey of uptake of UMI Phase 1 teaching materials

1: Questionnaire

To leaders of UMI 1 projects that produced teaching materials

Please copy this form if necessary and use a separate copy for each teaching product or module

Use and evaluation of UMI 1 materials during academic year 96/97

Name of module: .....

Name of project: .....

Form filled in by: .....

1. Was this module used in teaching during academic year 96/97?	Yes / No
2. How many courses used the teaching materials	.....
3. Was use of the materials a required part of any courses?	Yes / No
4. How many HEIs made use of the teaching materials	.....
5. Was any log kept of accesses to the web site where the materials are available	Yes / No

Evaluation of teaching success

6. Have you carried out any evaluation of the materials?	Yes / No
7. Can we have a copy of any evaluation report?	Yes / No

Ideally we would like to know:

8. What were the successes of the materials in teaching
9. What were the problems in teaching
10. What would need to be done to increase the success of the materials in teaching

11. Can you comment on these questions, and whether you might be able to provide information along these lines. If you have comments, please give them in the space below:

.....

.....

.....

.....

Overall

12. Would these materials have been developed without UMI funding?	Yes / No

13. Please indicate in what way UMI funding was used for this module (eg authoring, converting, moving materials to a new site?)

14. Would a collaboration of the sort involved in this project have taken place without centrally provided funds?

To leaders of UMI 1 projects that produced teaching materials

Please copy this form if necessary and use a separate copy for each teaching product or module

Use and evaluation of UMI 1 materials during academic year 97/98

Name of module: ……

Name of project: ……

Form filled in by: ……

1. Will this module be used in teaching during academic year 97/98?	Yes / No
2. How many courses will use the materials?	.....
3. Will use of the materials be a required part of any course?	Yes / No
4. How many students will have access to the materials?	.....
5. Can you log number of accesses of your web site during the coming year: by guests, by students (guest pages, study pages?)	Yes / No
6. How many HEIs plan to use the materials in teaching this year?	.....

Evaluation of teaching success

8. Do you plan to carry out an evaluation of students' experiences with the materials?	Yes / No

9. If so, can we have details of any evaluation plans, eg which term, carried out by whom. If possible, give details here:

2: Summary of Survey Responses

1. Was this resource used in teaching?

96/97	Yes 40	No 27	d/k 3
97/98	Yes 17	No 3	n/r 50

2. How many courses used the teaching materials?

96/97	44	n/r 13	d/k2
97/98	48	n/r 30	

3. Were the materials a required part of a course?

96/97	Yes 10	No 24	n/r 9	d/k 3
97/98	Yes 11	No 4	n/r 31	

4. How many HEIs made use of the teaching materials?

96/97	49	n/r 9	d/k 4
97/98	33	n/r 32	

5. How many students will have access to the materials in 97/98

Total Students: 2885

Resources where no response was given: 31

6. Was an evaluation of the materials carried out in 96/97

Yes 16 n/r 18 d/k 1

7.Is the evaluation report available?

Yes 11 No 2 n/r 21 d/k 1

8. Do you plan to carry out an evaluation of students experience of using the materials (97/98)?

Yes 10 No 6 n/r 54

9. Would you be interested in funding to carry out evaluation during the current teaching year (97/98)?

Yes 16 n/r 54

10. Was any log kept of web site access to materials (96/97)?

Yes 30 No 11 n/r 22 d/k 2 n/a 7

11. Can you log web site access during the coming year (97/98)?

Yes 5 No 4 n/r 58 n/a 2

12. Would these materials have been developed without UMI funding?

Yes 7 No 42 n/r 21

13. Would a collaboration of the sort involved in this project have taken place without centrally provided funds?

No 39 n/r 28 d/k 1

14. Reasons given for non-use of materials

Lack of available PCs	1
Network problems	5
Staff Changes	7
Lack of hardware	3

15. In what ways was UMI funding used?

Authoring	36
Digitising	11
Converting	16
Program Development	12
Use of Images and animations	1
Putting on the site	9
Every part of production process	3
Design	1
Equipment	6
Salary	5
No response	21

16. Will this resource be further developed in the future?

Yes	2
Will be part of UMI2	6

Appendix D: The UMI Steering Group

Professor Alistair MacFarlane (Chair)
Principal
Heriot-Watt University

Professor Arthur Allison
Vice-Principal (Information Services)
University of Glasgow

Dr Malcolm Bain
Director of Computing Laboratory
University of St Andrews

Professor Lesley Beddie
Head of Computer Studies
Napier University

Dr Richard Field
Vice Principal of Academic Services and Information Strategy
University of Edinburgh

Professor Alex Forrester
Vice Principal and Dean of Faculty of Science and Engineering
University of Aberdeen

Mr Dugald Mackie
Secretary to the Court
University of Glasgow

Dr Malcolm Read
Secretary
Joint Information Systems Committee

Professor John B. Slater
Pro Vice-Chancellor
University of Kent

Professor R. H. Trainor
Vice-Principal (Staffing)
University of Glasgow

Ms Sarah J Turpin
Manager and National Co-ordinator
FDTL and TLTP National Co-ordination Team

Mr David Beards
Policy Officer
SHEFC

Dr Paul Clark
Director of Teaching and Learning
SHEFC

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Appendix E: Criteria for awarding funds

Phase 1 of UMI took place during 1995/96. The funding was allocated in three strands, whose aims are explained below.

PHASE 1

Strand 1

a) improvements to local area networking capability including the provision of hardware necessary for end users to exploit the MAN capability

b) improvements in inter-campus connectivity within MANs

c) provision of studio facilities and supporting expertise to facilitate real time distance learning and improvements in communications generally through video conferencing.

Strand 2

a) the development of new software and materials

b) the adaptation of existing software and materials establishment and maintenance of a web or other servers and multimedia material banks on a subject basis.

Strand 3

a) resources to cover the costs of buying-in external expertise to provide training in the production and use of applications which exploit MAN technology or to provide cover to enable local staff to provide such training

b) financial compensation to departments wishing to buy staff time for attendance at training events and workshops either provided under (a) above or provided by other Council-funded, and therefore subsidised, initiatives such as the Learning Dissemination Initiative or Computers in Teaching Initiative

c) the development of training materials and the 'training of trainers' in the production and use of applications which exploit MAN technology.

PHASE 2

a) development of teaching materials for delivery over the MANs

b) in considering bids, priority was given to ensuring that the outcomes of the programme would be widely disseminated so as to provide benefit throughout the Higher Education system

c) the bid call stated that projects 'should form a substantial component of a course which will count for credit towards a degree or equivalent qualification from, at the latest, academic year 1998/99. The material should be relevant to both lecture and tutorial components of teaching'

d) proposals were encouraged to enclose business plans which would anticipate the take up of courses and indicate how courses would be delivered and developed after the period of SHEFC funding had expired

e) projects were required to include an evaluation component. This procedure was thought likely to include end users.

Bid calls and letters of explanation

A copy of SHEFC's call for bids and letters of explanation for Phase 1 and Phase 2 of UMI can be made available. Circular letters inviting and announcing bids are available on the SHEFC website at http://www.sfc.ac.uk/publications/intro.htm

Appendix F: Funds awarded to UMI projects

PHASE 1

Projects related to Teaching and Learning

Consortium for the provision of digital video and images on demand
University of Aberdeen
The Robert Gordon University,
Macaulay Land Use Research Institute
£119,000

MAN Accessible Resource Based Learning Exemplars (MARBLE)
University of Edinburgh
Napier University
Heriot-Watt University
£130,132

Materials for aural discrimination (NETMUSE)
University of Glasgow
University of Edinburgh
University of Strathclyde
Napier University,
Royal Scottish Academy of Music and Drama
£342,606

Phonetics teaching (Click & Listen)
University of Edinburgh
Queen Margaret College
£112,314

Functional Anatomy and Biomechanics (FAB)
University of Glasgow
University of Strathclyde
Glasgow Caledonian University
Paisley University
£178,280

OMNIBUS
University of Edinburgh
£88,625

Maths web server and hypertext tutorials
University of Dundee
£29,050

Philosophy web server
University of Dundee
£51,490

Clyde Virtual University (CVU)
Strathclyde University
University of Glasgow
Glasgow Caledonian University
Paisley University
Glasgow School of Art
£67,260

Medical MAN
University of Glasgow Medical School
£20,000

Co-Working for course design and project supervision
University of Strathclyde
£27,200

Providing Ethnological Archives for Research and Learning (PEARL)
University of Edinburgh
£38,000

Projects related to staff development

Teaching and Learning in Scottish MANs (TALiSMAN)
Heriot-Watt University
£633,900 (over 3 years)

Beginning to Use the Internet for Teaching and Learning (BEGINternet)
St Andrews College
£52,353

Raising awareness of the potential of desktop videoconferencing (TASCMAD)
University of Glasgow
£80,919

Preparing for FaTMAN: CAL into Mainstream Teaching
University of St Andrews
£63,225

Support for Web developers in ClydeNet
University of Glasgow
£21,720

Utilities in support of networked materials

Intelligent Discovery Of Materials on MANs in Scotland (IDIOMS)
Heriot-Watt University
£46,172

Enhance TLTP web pages; develop courseware over WWW (C-web)
Heriot-Watt University
£32,260

Using the MANs for research

Establish high-performance parallel computing on ClydeNET using workstation clusters (IMPACT)
University of Glasgow
£148,403

Psychological Image Collection (PICS)
University of Stirling
£35,200

PHASE 2

Clyde Virtual University (CVU)
http://www.cvu.strath.ac.uk/campus.html
Universities of Strathclyde, Glasgow
Glasgow Caledonian University
Paisley University
Glasgow School of Art
£100,500

National Learning Network for Remote Sensing
http://euromet.paisley.ac.uk/nln/welcome.htm
Universities of Dundee, Paisley, Edinburgh
£161,500

Finance Education in a Scaleable Software Environment (Finesse)
http://www.dcs.st-and.ac.uk/CompSci/UMI/Finesse.html
Universities of St Andrews, Dundee
Glasgow Caledonian University
£105,833

MAN-based Tutoring in Computer-Human Interaction (MANTCHI)
http://www.mantchi.use-of-mans.ac.uk/index.html
Glasgow Caledonian University
Napier University
Heriot-Watt University
£118,800

Child Health MediCAL
http://w3.abdn.ac.uk/umi2/
Universities of Aberdeen, Dundee, Edinburgh, Glasgow, Stirling
The Robert Gordon University
£119,800

Scottish Universities Mathematics and Statistics over the MANs (SUMSMAN)
http://www.maths.ed.ac.uk/~ama/UMI/
Napier University
Universities of Aberdeen, Dundee, Edinburgh, Glasgow, Stirling, Paisley, Abertay, Stirling, St Andrews
Heriot-Watt University
Glasgow Caledonian University
The Robert Gordon University
£143,000

Appendix G: Glossary

AbMAN	Aberdeen Metropolitan Area Network http://www.abman.net.uk
access permission	techniques usually involving use of user names and passwords to define what online resources are available to individual users
ALT	Association for Learning Technology
ALT-C	conference of the Association for Learning Technology
applet	a Java program which can be distributed as an attachment in a web document and executed by a Java-enabled browser
ATHENS	access management system which provides each user with a single identifier for access to numerous datasets and information services throughout the UK and overseas http://www.athens.ac.uk/
ATM	Asynchronous Transfer Mode. A technology for transferring data across network cables
ATOM	Autonomous Learning Object in MANTCHI
authentication	process of checking user information before giving access to online resources
C&IT	Communication and Information Technology
CAL	Computer Aided Learning
CBL	Computer Based Learning
cgi	Common Gateway Interface. Mechanism to allow transmission of data to and from web servers
ClydeNET	Glasgow and West of Scotland Metropolitan Area Network http://greenock-bank.clyde.net.uk/
COSHEP	Committee Of Scottish Higher Education Principals
courseware	learning materials designed for use on a computer
CTI	Computers in Teaching Initiative
data-sharing	providing a separate internet connection, PC, projector and screen in videoconference rooms; conference delegates in each studio can then all view the same PC-based or web-based information
DENI	Department of Education, Northern Ireland
DISinHE	Disability Information Systems in Higher Education. Information and strategic advice on how Information Systems can be used to support staff and students with disabilities
EaStMAN	Edinburgh and Stirling Metropolitan Area Network http://www.eastman.net.uk/
engine	software that carries out a complicated task
EuroMET	European Meteorological Education and Training http://www.euromet.met.ed.ac.uk/
FAQ	Frequently Asked Questions. Lists of questions and answers in particular subject areas, often published on the web
FaTMAN	Fife and Tayside Metropolitan Area Network http://www.dundee.ac.uk/itservices/fatman/fatmap.htm
groupware	software to enable people to collaborate over a computer network
hardware	the physical components of a computer or computer network
HEFCE	Higher Education Funding Council for England http://www.hefce.ac.uk/
HEFCW	Higher Education Funding Council for Wales http://www.niss.ac.uk/education/hefcw/
HEI	Higher Education Institution
HEIDS	Higher Education Information Directors in Scotland
hotspot	a word, phrase or image on a web page, used as a link page to further web-based information; clicking on the hotspot causes the linked information to be loaded onto the screen
hypermedia	an extension of hypertext to include graphics, sound, video and other kinds of data
hypertext	a collection of documents containing cross-references or "links" which, with the aid of an interactive browser program, allow the reader to move easily from one document to another
IMS	Instructional Management System. An emerging international standard for online learning materials
INET	the conference of the Internet Society http://www.soc.org/
ISDN	Integrated Services Digital Network. A set of communications standards allowing a single wire or optical fibre to carry voice, digital network services and video
IP	Internet Protocol. The set of network standards that allow the Internet to function
IT	Information Technology

Java	a platform-independent high-level object-oriented programming language; Java applets can be distributed as an attachment in a web document and executed by a Java-enabled browser
JENC	Joint European Networking Conference http://www.terena.nl/
JETAI	Journées Européennes des Techniques Avancées de L'Informatique
JISC	Joint Information Systems Committee http://www.jisc.ac.uk/
LTDI	Learning and Teaching Dissemination Initiative http://www.icbl.hw.ac.uk/ltdi/index.html
MAG	MANTCHI Answer Garden. Software developed by the MANTCHI project.
MAN	Metropolitan Area Network. A high-speed computer network which connects many of the large institutions in a geographical region.
Mbone	Virtual Internet backbone for Multicast IP. Method of connecting network hardware together to enable the Multicast method of data transmission
metadata	data about data. Metadata for web documents may contain information such as author, subject, date, related topics, etc
MLURI	Macaulay Land Use Research Institute http://www.mluri.sari.ac.uk/
multicast	efficient method of sending the same data to many users; data is not replicated until it nears its destination
network	computers joined together, usually by cable, so that information can be exchanged between them
PC	personal computer
platform	the combination of computer hardware and operating system (eg IBM PC running Windows 95, IBM PC running NT Server, Unix)
platform independent	a program or application which will run on many operating systems
RBL	Resource Based Learning
server	a computer which stores information and makes it available to other computers
SHEFC	Scottish Higher Education Funding Council http://www.sfc.ac.uk/
SMVCN	Scottish MANs VideoConference Network
SMCG	Scottish MANs Consultative Group
software	computer programs; programs enable computers to carry out tasks
T&L	Teaching and Learning
TLTP	Teaching and Learning Technology Programme http://www.ncteam.ac.uk/tltp.html
UKERNA	UK Education and Research Network Association http://www.ja.net/
UMI	Use of MANs Initiative http://www.use-of-mans.ac.uk/
utility	program to carry out some basic but important computer function