

An Overview and Analysis of ICT Solutions for Supporting Online Teaching and Learning

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Abstract

This paper outlines information and communication technology (ICT) options currently available to support online teaching and learning for students remote from the classroom. These options are considered in the groupings (i) Provision of materials, and (ii) Communication, with communication being divided into synchronous and asynchronous communication.

The strengths, weaknesses, and professional development implications of a range of options are outlined, including the requirements at the remote location where the student is accessing online resources. The relative costs of the options, including academic staff time to prepare suitable materials, the professional development of staff, and technical support to achieve the outcomes are explored. It is suggested that teaching staff should combine selections from each of the “provision of materials” and “communication” options in ways to design an online learning environment that suit the needs of teaching staff, the students, and the goals of the course.

Introduction

In recent times many educational institutions have started teaching online students who are at a distance from the campus, and the numbers of students studying at a distance, generally online, is increasing (Howell, Williams & Lindsay, 2003; Allen & Seaman, 2003; Allen & Seaman, 2004). The use of the term “online” in this paper refers to teaching and learning where the student may never visit the campus and the student and the teacher may never meet in the physical sense. This corresponds to Harasim’s (2000) term *Totally Online Mode* (“Totally online mode relies on networking as the primary teaching medium for an entire course or program”) and to Level 9 (“Entire course on the Web for students located anywhere”) of Bonk, Cummings, Hara, Fischler & Lee’s (2000) ten level “continuum of web integration in college courses.”

The ability to teach distant students online has come about due to the technologies now available to educational institutions and to students at their home or work. When an institution is considering teaching students remote from the campus they often consult with technology experts about the technologies available to support online teaching. However, it is suggested that more than the technologies need to be investigated when making these decisions, and that the professional development needs of staff who will be teaching using the technology, the technologies required by the student at the remote site, and the course content and goals must be taken into account. The decisions about which technologies and in which combinations can make or break the educational success of an online program. This paper is targeted at educators who are moving into online teaching and leaders in educational organizations who make decisions about the technologies used to support teaching and learning to give them an overview of the main technologies available and the implications that choices of technologies may have. Where appropriate, for some of the options reference to valuable “how to” documents are provided as such detail cannot be included here. Technologies used to support online teaching can be divided into two major groupings, with the latter group itself being divided into two. These are:

- **Provision of materials** to students
- **Communication** with students and between students
 - *Synchronous communication* (real-time communication)
 - *Asynchronous communication* (delay between contributions)

This paper gives an overview of the technologies available that institutions can select to support online teaching and learning. These technologies are changing rapidly and options that are a standard desktop tool today may have been expensive or unreliable a year or two earlier. This paper, therefore, can provide only a snapshot of the technologies currently available.

Online Teaching and Learning Experiences

The technical capabilities available when designing an online learning environment are now so powerful that, when well implemented, they are seen as having the potential to enhance students' learning experiences, yet many fail to gain the benefits from the potential learning that the online environment can support. Collis (1997, in Oliver, 1999) proposes that courses should be entirely redesigned to take advantage of the online environment. Presenting an on campus course as an online course without a major redesign and without deep consideration about which technologies are best to support the educational goals of the subject is not taking advantage of learning opportunities or the technologies available.

Quality learning experiences

All technical solutions that are selected to support online teaching and learning must have the goal of supporting learning outcomes, and it should be noted that supporting the social needs of the students as a group can support learning outcomes (Currin, 2003). Selected approaches must be well prepared, well implemented, technically robust, and reflect the high quality of teaching and learning that students expect. Teaching staff involved in online teaching and learning will need to consider carefully the design of the online learning environment and select appropriate technologies to ensure that the technologies meet their needs and the needs of their students. Different approaches to education of teaching staff may lead to a range of selections of ICT tools to support their online teaching (Chambers, 2003). Implementing technologies that the teaching staff are not capable of using effectively to support teaching and learning, that are not technically robust, or have requirements that students' computers do not typically have are unlikely to lead to successful learning outcomes or a satisfying experience for students or for educators. It needs to be noted that for some options there are technical issues that need to be resolved at both at the institution, over which there is control, and at the student's end, over which there is much less control. Choices of options should, thus, keep in mind technical requirements at *both* sites.

In addition to supporting the learning outcomes of each course, the students must also feel that they are getting a quality learning experience and be satisfied with the teaching and learning. It has been proposed that course satisfaction of online students is related to the student's satisfaction with the instructor, peer interactions, and attitude toward technology (Beffa-Negrini, Miller & Cohen, 2002). Developing a "learner profile" (Mishra, 2001) of a typical student, but being willing to support atypical students, may assist an organization in meeting the needs of their students.

Building on existing educational strengths

In most educational institutions moving towards online teaching and learning, or wanting to expand its offerings online, there are many educational strengths that can be built upon. Academic staff have substantial experience in teaching face-to-face and some may have experience with online teaching, while others may have some experience with intensive teaching with electronic follow up with students after the intensive classes. Communication with these students is often through individual consultations using telephone and email. Online discussion forums and chat have been used for many on campus courses and some staff will be experienced moderators of these discussion forums and chat sessions. There will, therefore, be a range of experiences of teaching staff in thinking about teaching online and a diversity of proficiency and comfort in using the various technologies for online teaching and learning. Thus, in most educational organizations, some staff will have experience in aspects of online teaching, but much development will be needed for many staff to develop an understanding of ways to teach effectively online and to design an effective online learning environment. The experience in teaching face-to-face of all teaching staff should be capitalized on, as this is an asset of the organization.

Acknowledging & meeting staff professional development needs

It must be acknowledged that although institutions may have some staff who have experience and expertise teaching online, there may be many staff with no experience in teaching online. Institutions need to provide the technical support and PD to meet these needs, and funds need to be allocated to enable it if many staff are to undertake online teaching. The institution needs to recognize that teaching online and developing an effective online learning environment is not a trivial undertaking and that the efforts involved need to be acknowledged and resourced.

Students with special needs

Websites for online courses should be accessible for users with special needs, such as the visually impaired, and should be designed to achieve “Bobby Approved” status, or similar. “Bobby Approved” means that the website has been checked and approved by *Bobby*, a web-checking product of the Centre for Applied Special Technology (see <http://www.cast.org>). Getting “Bobby approval” requires that websites are accessible to vision-impaired or blind users using a talking web browser. This is not difficult to achieve with the application of good web design principles and text labels for graphics.

Online students must have appropriate technologies, networking facilities, and ICT skills

Students who wish to enroll to study online must be made aware of the computer, networking, and ICT skills requirements. This information should clearly be available at the *Recruitment* stage (see Chambers, 2004 for the stages that online students progress through from recruitment to graduation). Teaching staff must be able to assume certain technical equipment and ICT capabilities for all students enrolled in online courses.

Technical options for supporting online teaching and learning

The options outlined here can be divided into the two broad categories of

- (i) **Provision of materials** to students
- (ii) **Communication** with students and between students.

The two major groupings of communication with and between students are based on whether the communication is “real time” (synchronous communication) or whether there is a time delay between when one participant communicates and others respond (asynchronous communication). Both synchronous and asynchronous communication have strengths and weaknesses, with synchronous communication (such as videoconferencing, chat sessions, or telephone calls) allowing any confusion to be clarified rapidly and a personal connection to be made between teaching staff and students to be established. Asynchronous communication (such as email or an online discussion forum) allows students time to compose and correct their writing before making it available to others and students do not need to be online at the same time as each other.

All options have a greater or lesser financial implication, with a not inconsiderable aspect being academic staff time, technical support and training, and professional development (PD) for academic staff. Without appropriate PD it is unlikely that an organization will succeed in expanding online offerings or ensuring that high quality is maintained. All options require a recognized workload for academic staff in preparing materials for online teaching and for developing the required skills for communicating with and supporting online students. For each of the options proposed a SWOT analysis (Strengths, Weaknesses, Opportunities & Threats) has been undertaken and the professional development and financial implications outlined.

Provision of Materials

For most online courses some materials will be provided to students in one form or another. The way these materials are provided to students will be determined by: the content and goals of the course, the lead-time available, the technology available at the student’s site, and the preferences and abilities of the teaching staff. Materials that exist

for on campus courses that are to become online courses may act as a starting point for online courses, however, any such materials will require substantial modification by academic staff to make them suitable for online learning and learning activities to facilitate online learning will need to be developed.

Materials can be provided to students in the following ways, each with strengths and weaknesses, and each should be considered in the specific context of each course, as the educational goals of each subject and the needs of the students should influence the decisions made.

- Paper materials
- Course Websites
- Materials on CD-ROM
- Audiocapture of lectures for distribution via the Web
- Audio CD-ROMs
- “Movies” on videotape or DVD

Communication opportunities need to be offered in addition the provision of course materials (see below for discussion of communication options).

Paper materials

Modes of Use

Provision of extensive amounts of text on paper can be appropriate for some content areas and may be more appropriate than provision of screens and screens of text that the student then prints. This will vary between academic areas, but should not be dismissed without consideration for text-intensive areas or if many students, for example, spend a lot of time traveling so that print materials are convenient for them to read when on a plane. For many online courses, however, except for an initial contact with students via paper mail before the commencement of a course to establish communication (in case there are any technical issues that prevent the student to connect to the institution’s resources) there seem to be little reason to send paper-based materials to most online students. If only relatively small amounts of “print” materials are part of the course materials, then distribution of these materials in Portable Document Format (PDF) for the student to print may be more appropriate.

Technical Issues: Institution

None. Materials can be reproduced locally and distributed to students. This would need to occur in time for all students to receive the materials, whatever their location, via the postal service. Copyright issues need to be addressed.

Technical Issues: Remote Sites

None. Only concern is the required lead-time to ensure that all students, whatever their location, receive the materials in a timely manner.

Educational Implementation Issues

Appropriate materials would need to be identified and/or developed. Materials need to be in an appropriate format and designed for students learning at a distance, not merely the same handouts used for face-to-face classes.

SWOT Analysis of paper materials

Strengths

- Useful support for other ways of providing materials.
- Staff are comfortable with print.
- Booklets are useful if there are large amounts of text-based materials.

Weaknesses

- Not adequate if used in isolation and without support of communication options (see below). Online students want more than “correspondence school” approach.
- Sometimes seen as old-fashioned and not making use of appropriate technologies.

Opportunities

- Potential to develop print based teaching and learning materials.

Threats

- Loss of reputation for the institution and loss of students, including future students, if used in isolation.

PD Implications

No substantial issues.

Other Financial Implications

Academic staff costs in developing materials (the major cost) and support staff costs for presentation and layout. Printing and shipping (or faxing) costs must be borne by the institution.

Course Websites*Modes of Use*

Most online courses have a website for students that provides course materials to students (text or multimedia) and also acts as a conduit to synchronous means of communication (such as chat) or asynchronous communication (such as an online discussion forum). The site may be a self-standing website or may be part of a learning management system.

Technical Issues: Institution

With standard technologies available there are no technical difficulties in serving websites rich with materials to support teaching and learning and in providing means of synchronous or asynchronous communication. Academic and technical staffing resources will be required to develop and maintain educationally rich course websites.

Technical Issues: Remote Sites

No substantial technical difficulties are envisaged in accessing websites. Some course websites may require software plug-ins and these must be made easily available to students. The formats of files and plug-ins required should be standardized across the institution to minimize the number of plug-ins that students require.

Educational Implementation Issues

Staff will need to determine appropriate ways to design and develop rich online learning environments. This will require PD exploring ways that this can be done. Communication opportunities need to be a part of the course website (see below for discussion of communication options).

*SWOT Analysis of course websites**Strengths*

- Allows students to access materials in their own time and place.

Weaknesses

- None envisaged—websites are standard for online courses.

Opportunities

- PD of staff in developing rich websites for online students.
- Resources developed are durable and can be revised and reused in following years, leading to improved course websites.
- There may be some items created for websites that can be re-used in other courses.

Threats

- None envisaged.

PD Implications

Staff may need PD in thinking creatively of ways to design course websites and may need both pedagogical and technical PD and support for developing the sites.

Other Financial Implications

Design and creation of course websites will require educational design and technical assistance.

Course materials on data CD-ROM*Modes of Use*

Sending students a CD-ROM containing large files, such as video and audio, which may not be feasible to deliver online could be useful for some courses. Copyright issues must always be addressed.

Technical Issues: Institution

Academic staff would need to determine and be involved in the development of materials sent to students. Development of the materials could be undertaken within the institution. Reproduction of CD-ROMs can be undertaken commercially, or in-house if in small numbers.

Technical Issues: Remote Sites

None envisaged. If video were to be included then links to (or, if legally possible, inclusion of) any plug-ins or applications required to play the video would be required. A choice of a single format of video should be made for provision of video materials to students so that it is consistent between courses offered by the institution.

Educational Implementation Issues

Academics need to develop materials suitable for this medium and mode of teaching. CD-ROMs need to be mailed in time for all students to receive them in a timely manner.

*SWOT Analysis of materials on CD-ROM**Strengths*

- CD-ROMs are good for providing large files such as video or audio.
- Students receiving rich materials for personal access without being required to connect to the Internet could make student feel well supported as there is no download time or costs for the student.
- Resources on CD-ROM can be referred (and linked) to course website.

Weaknesses

- CD-ROMS will need to be mailed in time for students at all locations to receive them before the commencement of semester.

Opportunities

- Reusable resources can be developed.
- Academic staff develop expertise in preparing materials for a range of media.

Threats

- The potential for breaches of copyright and Intellectual Property rights may increase if materials on CD-ROM, which are easily copied, are provided.

PD Implications

This would depend on materials developed, but would include PD for academic staff on suitable ways of creating the content and design for educational materials for online education.

Other Financial Implications

Costs for staff creating materials, costs for reproducing CDs and for shipping CDs to students will be incurred.

Audiocapture of lectures for access via the Web

Modes of Use

An increasing number of lecture theatres across the campuses of many institutions are equipped with systems that can automatically record lectures and make the files available on a course website. These systems digitally record the lecture and the file is then automatically compressed and posted to a server. The course website site is then updated automatically with a link to the newly available lecture, generally about an hour after the lecture is completed.

Technical Issues: Institution

If a system such as that is described above is in place at the institution then no particular technical issues are envisaged. The system used at the author's institution is *iLecture*, developed at the University of Western Australia (see <http://www.ilecture.uwa.edu.au/>). For institutions where such a system is not in place then it is a large undertaking to establish such a system.

Technical Issues: Remote Sites

None envisaged; students access streaming audio files via the course website. The *QuickTime* plug-in is required.

Educational Implementation Issues

Lectures are recorded as they are given, either to face-to-face classes or to an empty lecture theatre. Staff would need to be explicit and describe any graphics they use (or better to label them) and may need to combine audio of the lecture with visual materials (such as diagrams, images, graphs) available on the course website or sent to students in advance. Audio of lectures can be combined with a digital slideshow.

Further Information

For further information about this service see the University of Western Australia's *iLecture* website <<http://www.ilecture.uwa.edu.au/>>.

SWOT Analysis of audiocapture of lectures

Strengths

- Accessible by students at their home or work.
- Can be reviewed many times if required.

Weaknesses

- Recordings are not studio quality, but students are likely to accept lower quality audio as distributed via the web, as expectations are lower in this medium.

Opportunities

- Durable resources can be developed for potential use over a number of years

Threats

- None identified.

PD Implications

Staff may need some professional development in presenting in this format and developing visual materials that can be made available online to supplement the audio of lectures.

Other Financial Implications

Establishment of such a system in a range of teaching spaces has costs, but once in place the system is low cost to run as the audiocapture, file compression, and delivery of audio files is automated.

Audio CD-ROMs

Modes of Use

Audio CDs can be prepared by the institution and distributed to students to support online teaching and learning. A high level of audio quality is essential for audio CDs as user expectations for audio CDs are very high. It should, however, be noted that audio of a much lower quality can be delivered via the web or a data CD (see above), where audio is one of a range of components. The lower quality audio on these formats is generally perceived as acceptable because of users' lower expectations of this medium as compared to audio CD.

Technical Issues: Institution

Academic staff would need to create scripts and record them in the high quality sound studio. Reproduction of audio CD-ROMs can be undertaken commercially, or in-house for smaller numbers.

Technical Issues: Remote Sites

None envisaged; use of audio CD is unlikely to cause difficulties for online students.

Educational Implementation Issues

Staff would record a lecture or other audio materials in a high-quality recording studio. Audio materials may be used in conjunction with other visual resources (print or electronic); scripting and planning would be required.

Further Information

First section of the booklet *Audio/Audioconferencing for Distance Education and Open Learning* from the Commonwealth of Learning (McMullen, 2001) gives an excellent overview of this area.

SWOT Analysis of Audio CD-ROMs

Strengths

- Easily accessed by student at their home, car, or work.

Weaknesses

- If high quality audio is not provided the reputation of the institution as a quality provider of education could be put at risk. This can be managed by releasing only high quality materials via this medium, as user expectations of audio CDs are very high.

Opportunities

- Durable resources can be developed for use over a number of years

Threats

- The potential for breaches of copyright and intellectual property rights may be increased if the CDs are copied by students.

PD Implications

Script development would need to be undertaken and vocal training may be desirable for some staff.

Other Financial Implications

Script development and costs for hiring the recording studio and technician and reproduction of audio CDs would be incurred.

“Movies” on videotape/DVD

Modes of Use

Scriptwriting and professional production is required for extended video as expectations of students of materials they view on television are very high.

Technical Issues: Institution

Hiring a video crew with all equipment is costly (currently about \$1,000-\$2,000/day depending on number of cameras, etc.) and materials then need to be edited and produced in a professional manner.

Technical Issues: Remote Sites

Viewing of video by online students may present some problems due to different formats in different parts of the worlds (e.g., PAL, NTSC, SECAM, etc.).

Educational Implementation Issues

Staff would need to develop skills in aspects of creating video materials; this is a large undertaking, even with excellent technical support. There is an extended timeline for producing a quality product.

*SWOT Analysis of “movies”**Strengths*

- Produce durable outcomes that can be re-used.

Weaknesses

- Long timeline for production of high quality materials.
- Costly to produce.
- Looking unprofessional if production quality is not extremely high could lead to loss of reputation and students. Releasing only professional quality video materials can manage this threat.

Opportunities

- Durable outcomes; videos could potentially be used over a 3-5 year period.
- Skills can be developed in this area.

Threats

- The potential for breaches of copyright and intellectual property rights may be increased if the materials are copied by students.

PD Implications

Substantial—producing extended video is a large undertaking.

Other Financial Implications

High costs of all aspects of production; reproduction and distribution costs are reasonable.

Synchronous Communication

Synchronous communication allows “real time” conversations to occur and has the advantage of rapid clarification of questions and the projection of the personality of participants. Synchronous communication tends to be less formal with text communication being brief and rapid contributions, while asynchronous communication can be more considered, as participants have time to edit their responses before posting them (Lapadat, 2002). Conversely, participants may become more reserved and self-conscious during videoconferencing due to the presence of the camera.

The major disadvantage of synchronous communication is that participants need to be available at the same time, which may cause difficulties if online students are scattered across a range of time zones.

Video Conferencing*Modes of Use*

Videoconferencing allows staff and students to see and hear each other as they discuss issues related to the course. The lecturer can meet with students online and, depending on the technologies available and chosen, students could also see and talk with each other online. Students would need to gather at locations with appropriate equipment and technical support, which may not be generally feasible for online students who are scattered at a range of locations.

Unless students are clustered and can gather together at study centers with the equipment needed this option is difficult to implement, as the cost of videoconference equipment is beyond the means of most home users. Internet Protocol (IP) videoconferencing is substantially cheaper to implement than Integrated Services Digital Network (ISDN) videoconferencing but other issues are much the same.

Technical Issues: Institution

ISDN videoconferencing will (generally) have good quality images but if the connection fails it needs to be re-established. An advantage of ISDN videoconferencing is that the line is dedicated to the videoconference, whereas with Internet Protocol (IP) videoconferencing the bandwidth available for data for the videoconference is not guaranteed and cannot be controlled. The images on IP videoconferencing are of variable quality, sometimes low quality, depending on internet traffic at the time.

Technical Requirements: Remote sites

Videoconferencing requires that there is suitable technology at each site and adequate technical support at each end to troubleshoot any difficulties that may arise. Required bandwidth is at least 1 megabit or image quality will be unacceptable. Technical support is required to ensure the system is functioning and to direct the camera if there are a number of participants. Access to this level of technology at the many sites online students are located makes it an unlikely option unless study centers are available at a range of locations for students.

Educational Implementation Issues

Teaching staff must determine in advance if they wish to present as a “talking head” or supplement this with images, whiteboards, *etc.* If more than a “talking head” then document cameras, or similar, will need to be deployed.

Materials need to be prepared and made available to students before the videoconferencing session, possibly via the course website or via mail or fax.

Teaching using videoconferencing is different to teaching face-to-face and academic staff would need to make extensive preparations such as getting materials to students, preparing suitable graphics, *etc.* Selection of suitable attire (not stripes, patterns or florals) needs to be considered as well as moving enough not to look like a statue, while limiting movements as this can lead to a degradation of image quality. Rehearsals would be important in developing comfort and confidence in teaching with this technology as even a slight time delay between making a statement and the others hearing it can be off putting at first.

Further Information

Pacific Bell has produced resources that give valuable advice about videoconferencing techniques. Recommended readings are *Videoconferencing: Planning for 2 way video*, *Videoconferencing: Communication Skills* and *Videoconferencing: Instructional Strategies* (Pacific Bell, 2003). These resources should be consulted for a more detailed analysis of implementation issues and checklists to support teaching with videoconferencing.

SWOT Analysis of ISDN videoconferencing

Strengths

- Real time interaction.
- Technology is available.
- May satisfy some students’ requirement for “contact” with their lecturer.
- Both image and voice.
- Potential to establish relationship with and between students.

Weaknesses

- Need specialist equipment and technical support at both sites.
- Steep learning curve for teaching staff to manage teaching in this way.
- As with all synchronous communication students need to be available at the same time, so there may be time zone issues.
- ISDN videoconferencing can be costly.

Opportunities

- Opportunity to develop expertise in this area.

Threats

- Loss of reputation for the institution and loss of students, including future students, if implementation is not successful. This threat can be minimised by ensuring adequate technical equipment and support at both ends and extensive PD, mentoring of teaching staff in this mode of teaching, and technical and teaching rehearsals.

PD Implications

PD may be required for academic staff who choose to teach in this way. Coaching and mentoring of staff may be required, as will opportunities to rehearse using the technology in advance of taking classes.

Other Financial Implications

There are costs in providing technical support in setting up the system and in being available to troubleshoot for each the videoconferencing session at each site. Building supervisors may need to be available for opening buildings at night if late night videoconferencing is required to meet the time zone needs of remote students and a security service may need to be provided to escort staff to and from buildings if they are teaching alone at night.

Web Conferencing*Modes of Use*

Web conferencing uses WebCams (small video cameras that attach to a desktop computer that are low cost, generally under \$100) used in conjunction with software allows images (video or still), voice, and data to be shared online, while only having minimal technical requirements. The video images may be small and of low resolution and the audio is telephone quality. Data or file sharing and a “shared whiteboard” can make a web conference a rich online environment for teaching and learning or for establishing a sense of community. Despite sometimes low quality images, web conferencing is a powerful way to gather students online and is technically viable for most online students. The sense of connection between participants, even with poor images, is much higher than if there are no images. Users do not have high expectations about the quality of these images so poor image quality does not generally lead to dissatisfaction, unlike users’ expectations of image quality on, for example, a DVD. The images support the voice communication, which is generally stable, and add a “human touch” to the interactions.

AOL Instant Messenger and iChat, although lacking the “whiteboard” feature, allow low cost one-to-one web conferencing. Using these free applications (PC and Mac respectively, and compatible with each other) the teaching academic could have scheduled one-to-one consultations with students or can take a video chat request much in the same way as answering the telephone. These free applications allow sharing of files, text chat, audio chat, and web videoconferencing.

Technical Issues: Institution

None envisaged—technical requirements are minimal beyond standard desktop requirements, a WebCam and connection to the Internet.

Technical Issues: Remote Sites

None envisaged—technical requirements are minimal beyond standard desktop requirements and Internet connection. Students would need a WebCam if they wished to display video from their end, though this is not compulsory to join a web conference, and would require appropriate software. There is free web conferencing software available; institution-wide standards that allow cross-platform connections and is reliable would need to be chosen.

Educational Implementation Issues

Staff would need to consider the purpose of the web conference and have materials prepared if a class web conference is scheduled. Appropriate etiquette would need to be understood by participants.

SWOT Analysis of web conferencing

Strengths

- Video, audio and data sharing with a number of participants.
- Cheap and technically simple solution.
- Students can participate from their home or workplace.

Weaknesses

- Often low quality video, though expectations of students are not high for video in this format so this is not a major concern.
- As with all synchronous communication students need to be online at the same time so there may be time zone issues.

Opportunities

- Great and viable way to get students together online to build a sense of community and facilitate interactions.
- Good way to establish relationship between academic and student.

Threats

- None envisaged.

PD Implications

Staff would need to rehearse using the technology and in managing web conferences and teach students appropriate web conference behaviors.

Other Financial Implications

The institution may consider purchasing a set of WebCams and loaning them to online students, or make a WebCam a technical requirement of online students if web conferencing is to be used in many courses. Licensing of web conferencing software and provision of licenses to online students (if a free product is not selected as the institution's standard) may be required.

Online Chat

Modes of Use

Online chat can be used to converse via text in real time with remote participants. The lecturer can chat with an individual student, with a small group, or with the whole class (though having a whole class participating in a chat session is not recommended unless the class is very small). Chat sessions could be scheduled and advertised to students via the course website or email, or arranged (probably via email) with individual students. Another use of chat is for the lecturer to have advertised "virtual office hours" when the lecturer is available for an unstructured chat session to sort out any issues students have, or for a Q&A session. Students can also chat in sessions independent of the lecturer, for example in study groups, and a chat session could be a follow up activity after students listen to a lecture available on the web or after completing an activity. Transcripts of chat sessions can be made available to students as a learning resource.

Technical Issues: Institution

A range of free online chat sites are available (though using such a service is not recommended as unwanted "intruders" may potentially disrupt a class session) and software required to host chat is available as a part of learning management systems or standalone and thus could be made available for all courses. No specialist software or hardware is required for participants. Very little technical training or support is required for staff to become able users of chat although, as discussed below, using Chat for educational outcomes will require some professional development activities.

Technical Issues: Remote Sites

No special technical needs are required above the usual computer, network connection, and web browser. Students should be able to engage in chat from their home or office.

Educational Implementation Issues

Staff must have a goal when establishing a chat session, with defined outcomes that may be learning or social outcomes. Chat can be used with the lecturer and the whole class (not recommended with large classes), with small groups, or an individual student or between students without the lecturer. Although technically uncomplicated, there are strategies and techniques that need to be learned by the lecturer to manage an effective chat session. Rules and norms of behavior in chat rooms also need to be learned by students and staff. Staff will need to schedule chat sessions or make appointments with students or groups of students for chat sessions.

Further Information

For practical advice on hosting a chat session for learning see *Strategies for Effective Use of Chat: When, Why, and How to Make It Work* (Weber & Lieberman, 2003).

SWOT Analysis of online chat

Strengths

- “Live” and synchronous contact with lecturer.
- Technology is in place.
- Cheap and easy at both ends.
- Technology is easy to learn.
- Technically reliable.

Weaknesses

- Text only (no video); although many chat applications also allow documents to be shared.
- Students need to be online at the same time.

Opportunities

- Opportunity for staff to develop skills in this area.
- Chat is a good way to establish a sense of community and develop relationships within the class.

Threats

- None envisaged.

PD Implications

Some PD may be required for educational and implementation aspects of chat (much less than for videoconferencing); little technical PD will be required.

Other Financial Implications

No costs for technical support; no additional costs for hardware or software; some PD may be required.

Telephone conferencing (Conference Calls)

Modes of use

Telephone conferencing, audioconferencing, or conference calls are all terms to describe people meeting via the telephone. For online teaching and learning it would entail the lecturer speaking with students scattered at a range of sites all connected to the conference call, allowing voice communication between all participants. Conference calls needs to be booked and costs are substantially higher than for a telephone call to a single site. Telephone conferencing, where high quality audio is ensured, can be combined with data conferencing so that an electronic whiteboard is available and file sharing is available in addition to voice.

Technical Issues: Institution

Telephone conferencing is a stable technology that has been available for many years. A standard telephone connection is required and if more than one caller is being connected then a conference call must be organized.

Technical Issues: Remote Sites

The students require only a telephone and stable telephone connection.

Educational Implementation Issues

There is etiquette for hosting a conference call that needs to be learned, though these are not as complex as those for videoconferencing. The interactions need to be carefully managed to avoid speaking over others and, as no body language is communicated to those at the remote sites, care with language is required. New styles of engaging and maintaining engagement are required. Student groups of no more than eight are recommended.

Further information

See McMullen (2001) *Audioconferencing in Support of Distance Education* from the Commonwealth of Learning for advice in this area.

*SWOT Analysis of telephone conferencing**Strengths*

- High quality audio over a dedicated telephone line.
- Technology is stable and easy to learn.
- Can be combined with data conferencing.
- Could be effective following an audio lecture or a class activity.

Weaknesses

- Whole class is likely to be too large for a single call; would need to “meet” in smaller groups (no more than perhaps eight students).
- Students need to be available at the same time.

Opportunities

- Opportunity for staff to develop expertise in teaching in this way.
- Personal and live contact with the lecturer and other students to establish/reinforce relationships and sense of community.

Threats

- None envisaged.

PD Implications

Some training may be required for learning conference call etiquette and teaching this to students.

Other Financial Implications

Call costs can be high if many sites are connected to.

Individual Telephone Consultation*Modes of Use*

Students can be scheduled (via email) for telephone consultations with teaching staff. This could be time consuming if all students have individual consultations, and timing requirements may mean lecturers working late at night to match with needs of students in different time zones.

Technical Issues: Institution

None envisaged.

Technical Issues: Remote Sites

None—students must have access to a telephone.

Educational Implementation Issues

Most staff have extensive experience with individual telephone consultations with students. The lecturer should schedule calls with students via email, setting a start and finish time for the call and confirm the telephone number that the staff member will call. It may be appropriate for staff to initiate calls to students in different time zones from the

staff member's home (rather than from on campus) and have call costs reimbursed, rather than staff being on campus late at night.

SWOT Analysis of telephone consultations

Strengths

- Stable technology in place.
- Easy access for students.
- No technology training required.
- No PD required.

Weaknesses

- Call costs; though not likely to be a major cost.
- Time consuming if all students require individual consultations.

Opportunities

- Personal contact to build sense of community.

Threats

- None envisaged.

PD Implications

None.

Other Financial Implications

Call costs.

Asynchronous Communication

Asynchronous communication is where there is a time delay between one participant's contribution to the discussion and the response from other participants. Although lacking the immediacy and some of the advantages of synchronous communication, asynchronous communication allows participants the time to compose and edit their contributions and take time to consider before they respond to the postings of others. This can be valuable when participants are working in a second language or are reserved. Asynchronous communication offers greater flexibility for the learners as they do not need not be available at the same time and avoid time zone or other availability issues.

Online Discussion Forum

Modes of Use

An online discussion forum allows participants to post comments or questions that the whole group can view and respond to. Data files of any sort can be attached to a posting. An online discussion forum can, for example, be a place for students to discuss matters, for the lecturer to guide a discussion, or for the lecturer to answer questions from students. The teaching staff would need to check and respond to the discussion forum on a regular basis so that questions are not left unanswered. Students should be told how often the lecturer or tutor will be checking and responding to the discussion forum so that expectations are clear. If a student is expecting daily responses but only gets them weekly this can lead to frustration and disengagement, whereas if the student is told that only weekly responses will be made, this frustration can be reduced. Setting and meeting students' expectations is important in online teaching.

Technical Issues: Institution

None—many varieties of online discussion forum software are available.

Technical Issues: Remote Sites

None—usual networked computer with browser is all that is required for participating in an online discussion forum.

Educational Implementation Issues

Active moderation (and stimulation) of the online discussion is required to facilitate learning. There are examples of effective uses of online discussion forums for online learning activities that could be used as models.

Further information

See *Developing learning through effective online moderation* (Salmon, 1998).

*SWOT Analysis of online discussion forums**Strengths*

- Stable technology.
- Easy access for students.
- Students can access discussion forum from home or workplace.
- Student and staff images can be displayed.
- Attaching documents for sharing among the participants is enabled.
- No time zone issues.

Weaknesses

- Text only within the discussion, although any sort of electronic document can be attached for sharing with the class.

Opportunities

- Staff development in this area will be valuable for all teaching.
- A sense of community can be established if well implemented.

Threats

- None envisaged.

PD Implications

Some staff may need some technical training on using an online discussion forum; PD may be required to learn how to manage an online discussion forum to support learning and to develop and support an online community.

Other Financial Implications

None expected.

Individual Email Consultation*Modes of Use*

Most teaching staff are experienced in the common practice of answering queries from students via email and email is well suited to this. Individual email consultations with students can be streamlined by developing a considered response to a question from a student, and then consequently reusing this response, tailoring it where required, when similar questions arise from other students. Responding to many emails is very time consuming for academic staff for courses with many online students; tutors may be required to support lecturers so that all emails are responded to quickly. Regular checking and responding to email is required and expectations should be established, for example, telling students that the lecturer does not respond to emails from 5pm Friday to 9am Monday, or that emails will be responded to within 48 hours.

Technical Issues: Institution

None. Any institution offering an online course will have a good email system.

Technical Issues: Remote Sites

None. Any student enrolling in an online course will have reliable access to email.

Educational Implementation Issues

The volume of email may require some support from tutors for large online classes.

*SWOT Analysis of email consultation**Strengths*

- Stable technology in place; no technology training required.
- Easy access for students and staff.
- Individual consultations between staff & students.
- A relationship can be developed between the lecturer and students.
- No time zone issues.

Weaknesses

- Time consuming if all students require individual consultations, although tailoring and reusing responses to earlier questions could reduce this.

Opportunities

- A “Frequently Asked Questions” file, with responses can be developed.

Threats

- None envisaged.

PD Implications

None.

Other Financial Implications

Academic staff time and the possible need for tutors to respond to email may need to be resourced.

ListSerts*Modes of Use*

A ListServ is a system that allows an email sent to a Listserv address to be automatically sent to all subscribed members of that list. In the current context the subscribed members would be teaching staff and students enrolled in a particular online course. The lists need to be maintained. Contributions from any email address can be distributed via a ListServ, this allows students using non-institutional email accounts to post to the List, but can make the List vulnerable to spam, although ListServ software has spam detection and elimination capabilities.

Technical Issues: Institution

No difficulties envisaged. Email addresses may need to be manually updated.

Technical Issues: Remote Sites

None envisaged; students receive postings via email.

Educational Implementation Issues

None envisaged.

*SWOT Analysis of ListSerts**Strengths*

- Technology is stable.
- Easy to use.
- Students can access from any email address.
- Email-based discussion that does not require students to check on the progress of a discussion on the course web site.
- No time zone issues.

Weaknesses

- As postings can come from any email address there is a possibility of mischievous postings.

Opportunities

- Rapid and direct communication with students via email.

Threats

- If a virus is posted and not detected and eliminated it would be sent to all students. This could lead to substantial problems.

PD Implications

None envisaged.

Other Financial Implications

Manual maintenance of email addresses may be required.

Conclusions: ICTs to Support Online Teaching & Learning

As can be seen there are many options to choose from, each with strengths and weaknesses. It should be noted that ICT is a rapidly moving field and more options will become available that will need to be considered as they become available for students and institutions. Provision of effective online learning materials to students as well as communication with and between online students is needed. It is recommended that teaching staff take time to consider the ways that various technologies can support their educational approach to teaching, the materials to be addressed, the goals of the course, and student learning in their courses and to then make a selection from the options outlined. Institutional leaders should be guided by the educational needs of the online subjects not just the availability of technologies when implementing ICT “solutions” for online teaching and learning. Teaching staff should consider their approach to education, the modes of communication that they think will best suit their teaching style, the learning needs of their students, and the content of the course when selecting technologies to support their online learning environment. Carefully chosen and well-implemented information and communication technologies can combine with great educational design to lead to rich online learning environments that are satisfying for both teachers and students.

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