Distance Education Technologies and Implementation

Table 1: Summary of Major Distance Education Technologies

Technology	Advantages	Disadvantages
Print	Materials Inexpensive Portable High comfort level Readily available	No interactions Limited sensory involvement Requires reading skills Time delay
Voicemail	Low cost Easy to use Increases interactions	Length may be limited No visual cues May involve toll charges
Audio files/CD	Inexpensive Easily accessible Easily duplicated	No visual cues No interaction
Audioconference	Inexpensive Easy to set up	No visual cues Requires hardware
E-mail	Flexible Interactive Convenient	Requires hardware Software variations
Online Chat	Real-time interactions Instant feedback	Requires similar software Must be scheduled Requires hardware
Web-based Education	May incorporate multimedia Worldwide access Interactive	Requires computer Requires Web access May be slow
Videotape/DVD	Inexpensive Easily accessible Easily duplicated Audio and visual elements	Complex to record No interaction Requires hardware
Satellite Videoconference	High realism May be interactive	Expensive hardware Must be scheduled Usually one-way only
Internet Videoconference	High realism May be interactive Relatively inexpensive	Must be scheduled Small windows May be slow, jerky video
Cable/Broadcast Television	Easy to use Easily accessible May be videotaped Includes audio and visual	High production costs Requires hardware No interaction Must be scheduled

Source: 2009. "A Teacher's Guide to Distance Learning." http://fcit.usf.edu/distance/default.htm

The earliest forms of distance education were little more than self-taught courses wherein course materials were delivered to students via postal mail and assignments were returned to instructors along the same route. Correspondence courses of this

type still exist and are an option for students that do not have a reliable access to internet or telephone. However, even they can now be delivered on a CD-ROM (containing either audio files or some other computer-based media, such as PDF or PowerPoint). Given the importance of technology in modern distance education, it is important to understand the strengths, weaknesses, and potential of technologies currently in use. Such comprehension will enable administrators to make more informed decisions when it comes to course design and implementation.

Print Materials

Though there are numerous new options available to educators in distance education, print remains a significant component of most courses. In 2004, it was reported that only 24 percent of distance students had high-speed internet at home.[5] While this number has number has certainly increased in the last six years, open and distance education programs could exclude potential students if they move entirely away from print material.

There is potential for print material to serve as either the primary source for course instruction or as a supplementary source – i.e. textbooks or other printed required readings. In this case, communication via email or other electronic means could be utilized for student questions, assignment submissions, and instructor feedback.

Printed study guides have been identified as a key resource for distance education courses even if other forms of media are primarily used to deliver the content. Supplemental print materials such as these may be disseminated via regular email or even via a course website.[6]

Advantages of Print Materials

- ❖ **Extremely portable.** Print materials can be used in any location.
- ❖ **High comfort level.** Most students are very comfortable using print materials to learn.
- ❖ **Cost effective.** Print materials can be created and duplicated with little expense.
- ❖ **Readily available.** Many distance learning courses can take advantage of existing textbooks, thus saving the time and expense of creating custom materials.[7]

There are several advantages to print media that are likely related to why it has remained, and will continue to remain, an important resource for distance education. Once printed or distributed, students are able to bring these hard copies with them

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[5] Gunawardena, C., and McIsaac, M. Op. cit., 1.
[6] 2009. "A Teacher's Guide to Distance Learning." http://fcit.usf.edu/distance/default.htm
[7] Ibid.

anywhere they go. This allows for study at any number of locations. This can be important to distance learners since many of them choose distance education due to responsibilities that prevent them from being at the same place at the same time on a regular basis. Print materials also do not require batteries or advanced technology to support their use (other than a reading light), and by the time they reach higher education most students are accustomed to using print materials for learning.

Disadvantages of Print Materials

- ❖ **No interactions.** Print materials do not generally provide built-in interactions. Additional technologies, such as e-mail, must be supplemented.
- ❖ **No audio/visual elements.** Print materials are static and are not appropriate for teaching languages and visual concepts.
- ❖ **Require reading skills.** If the learners are non-readers or language skills are required, print materials will not be effective.
- ❖ **Time delay.** It may take days or weeks for printed matter to travel between student and teacher.[8]

Printed materials are limited in terms of what they can provide to a potential learner. Clearly they do not provide the opportunity in themselves for two-way interaction with the instructor or other students. Only certain content can be delivered effectively via print – language courses that require an audio component will require additional resources. Learners also need well-developed reading skills in order to be able to utilize print successfully. The time it takes to deliver materials to the student is something else that should be taken into consideration.[9]

Guidelines for Incorporating Print Materials

- ❖ **Distribute print materials well in advance.** Although the mail system is generally quite reliable, issues may arise if the print materials are not distributed well enough in advance.
- ❖ **Include clear directions for use.** Students need to know exactly which print materials they are responsible for reading and the specified timeline.
- ❖ **Require interactions.** Print materials are inherently non-interactive. Therefore, you must design for the required interactions. In some cases, this may mean a specified timeline for e-mail messages, or a required number of postings to a listserve.
- ❖ **Specify a timeline.** Distribute a timeline for students to help them organize their study learning activities.[10]

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[8] Ibid.
[9] Ibid.
[10] Ibid.

Audio Technologies

Another cost-effective method of enhancing a distance education course is to incorporate some form of audio or voice technologies into delivery. This can be as simple as a telephone with voicemail or as sophisticated as an audioconference.

Voicemail

Voicemail has become a very common mode of contact when speaking or interacting directly is not possible. One resource explains that voicemail has a great deal to offer distance learning initiatives. Through voicemail students are able to leave messages for instructors regardless of the time. Advanced voicemail systems can enable instructors to leave messages for whole groups students at once. Further, this mode of communication can substitute for email for those students that do not have internet. The main advantages of voicemail are that most people in developed nations and ever-increasing numbers in less-developed countries have telephone access and voicemail messages can be checked at any point during the day (or night). However, the length of messages is usually limited and students calling from outside the local area must be provided with a toll-free number for access. Given these limitations voicemail is usually used to supplement other methods of delivery in a course.

Audio Files and CDs

CDs and Audio files represent another inexpensive resource that can be combined with other implementation techniques. Entire lectures can be delivered via audio files as well as panel discussions or instructions for the student. As one publication notes, "audio is especially useful in courses that require nuances of inflection, such as foreign languages, or those that are designed for non-readers." Though audio files are easy to create, duplicate and use, they are not interactive and do not provide visual elements that many students may need or want.[11]

Audioconferences

As noted, telephones are one of the world's most accessible communication technologies. As such, their use can be vital in the effective delivery of distance education. Via telephone instructors can reach a potentially large number of students – even simultaneously via a conference call. At locations with speakerphones multiple students are able to gather to interact with an instructor or each other under the instructor's guidance. Using more advanced audioconference systems and what are called bridges, numerous individuals can call into a toll-free number and essentially attend class (audibly) or engage in discussion over the phone. Again, for

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[11] Ibid

students that do not have access to the internet or a computer, audioconferences are a viable option for fostering interaction and the sense of community – something researchers have pointed to as essential elements of an effective distance course.[12]

One thing to note, however, is that though audioconferences are relatively easy to set up and conduct, it may be difficult to retain students' interest for a long period of time given the lack of visual stimulation on a phone call. Therefore, audioconferences for distance courses should not be too long, should be well-planned, and it is important to supplement them with visual media distributed in advance.

Podcasts

Podcasts can be used to make digital audio and video files easily accessible to students with internet access and preferably their own computer. Learners are able to set their computers to automatically download new "episodes" in a series that is posted online. This is very easy for them to do. They simply tell their software to subscribe to the RSS (Really Simple Syndication) feed and the latest episodes (or posted files) are automatically downloaded to their computer. These files can then be transferred to more portable playback technology such as CD or an audio device, for example an iPod or PDA (the term Podcast comes from combining iPod and broadcasting). They can also be played with any number of media programs installed on most computers.

Many students of the "Net Generation" will be fairly comfortable with the use of podcasts since they were originally created as a feature on the popular music downloading program, iTunes. Less technology-capable students may have trouble setting up a podcast on their machine and will likely need assistance or explicit guidance. Of course, if podcasts are incorporated as a major element of course delivery, instructors need to be certain that students have a computer (or at least have regular access to a computer).[13]

Advantages of Audio Technologies

- ❖ **Inexpensive.** All of the audio/voice technologies are relatively inexpensive.
- ❖ **Easily accessible.** Most people around the world have access to a telephone (either landline or mobile). In addition, most students in developed countries will have access to an audiotape player in their home or in a car.

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[12] Gunawardena, C., and McIsaac, M. Op. cit
[13] 2009. "A Teacher's Guide to Distance Learning."

❖ **Easy to use.** Almost everyone is comfortable using a telephone and an audio cassette. With voice technologies, there is no software to install and no hardware to configure.[14]

The main advantage of audio technologies is their cost-effectiveness. Though they are easy to use and most people around the world will have the required devices necessary to take advantage of audio, there are certainly potential students that may not have the suitable technology for access. This should be kept in mind when planning a distance course that will utilize audio. Costs for students and schools may increase if special accommodations need to me made.

Disadvantages of Audio Technologies

❖ **May require scheduling.** Some of the voice technologies (such as audioconferences) are synchronous, meaning that they must be scheduled at a convenient time for the students and teacher.
❖ **Not conducive to visual information.** Many students find it hard to focus and learn strictly through audio input. In addition, audio-only format restricts the content that can be conveyed (abstract concepts are very difficult to convey through audio).
❖ **May be impersonal.** With audio-only interactions, there is no eye contact and no body language. Students may be "turned off" by a talking box.[15]

Clearly scheduling issues need to be considered for any form of synchronous delivery. One of benefit that attracts students to distance education is the ability to access information at one's own schedule. While podcasts, CDs, audio files, and even voicemail allow for this, audioconferences do not. Again**, interaction and a sense of community have been established as key determinants of student satisfaction in distance courses.** If audioconferencing is not used to allow for both, some of the technologies discussed in the next sections should be incorporated into overall course implementation to foster such an environment.

Guidelines for Incorporating Audio Technologies

❖ **Distribute visual materials in advance.** If an audioconference is scheduled, handouts or other visual materials that might be of value during the presentation should be distributed well in advance.
❖ **Set communication protocols.** Since the participants will not be able to see each other, it is important to agree on protocols to help identify the speaker in an audioconference.
❖ **Encourage interaction.** In an audioconference, interactions should be built into the format. For example, instructors should call on specific students,

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[14] Ibid.
[15] Ibid.

instruct students to take turns asking questions, and make sure that one student is not allowed to monopolize the conversation. With both audioconferences and audiotape delivery, students should be required to use e-mail, fax, or voicemail to engage in further interactions with each other and the instructor.

❖ **Record audioconferences on audiotapes.** It is very easy to record an audioconference. That way, you can distribute the tapes for students who were unable to participate in the conference and for those who would like to review the content.

❖ **Get to know the students.** If possible, seek ways to get to know the students, such as visiting the remote sites, gathering the students together in one place, or exchanging photographs or videotapes.[16]

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[16] Ibid.

Computer Technologies

As internet usage continues to increase around the world computer technologies are becoming more commonplace in the delivery of distance education. Online learning does not necessarily imply distance learning as many traditional higher education courses now utilize internet-based course management software to aide in the learning process. Nonetheless, much research has gone into establishing best practices and guidelines for internet-based distance education courses and programs. E-mail, online collaborations, and Web-based education have been identified as the primary computer technologies used for distance education. Obviously, only students that have reliable computer and internet access will be able to enroll in courses that utilize these technologies.[17]

E-mail

E-mail messages are a relatively simple and inexpensive way for instructors and students to communicate throughout course implementation. Occasionally, designers plan an entire course around e-mail communication. This works particularly well for students that prefer asynchronous instruction and allows students that may be too shy to speak up in a traditional face-to-face course to interact with the instructor. More often, e-mail is best used to supplement print, audio, or video technologies.

In addition to conventional e-mail communication, bulletin boards and listserves can also be used to improve the quality of a distance course. Bulletin boards are online discussion groups or newsgroups where students and instructors can post messages that everyone subscribed to the group can read and reply to. Most instructors will be familiar with listserves, which can similarly be used to send an e-mail message to a list or group of students. Bulletin boards and listserves can be an effective way of facilitating interaction among students and with the instructor.

E-mail is also a convenient way to distribute various files as attachments, such as PowerPoint presentations, spreadsheets, of PDF documents. These types of files are themselves computer technologies and for internet-based courses they can be used to supplant printed materials so long as students are comfortable with their use.

As mentioned, e-mail is inherently asynchronous – students do not need to be logged in at the same time to receive them – and this is one of the main benefits of e-mail technology. It can be accessed any time, day or night. Furthermore, email accounts can be obtained for little or no cost. In most cases, the only cost of an email account is the cost of an internet connection. Of course, the requirement of an internet connection is also the main disadvantage of e-mail software. Students will need to learn the use of email software which includes knowing how to access and download

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[17] Ibid.

attachments. As one resource notes, "Prior to involving students in e-mail instruction, you must ensure they have all the hardware, software, and knowledge to make the communications successful."[18]

Online Collaboration: Internet Chat and Conferencing

Though email is asynchronous, as most educators are aware, there are synchronous computer technologies that can be utilized for distance education courses. These include online chat, shared white boards, and videoconferences.

Online chat, also called instant messaging, can be between two people, for example instructor and student, or numerous people via a chat room. As each person types and enters a message the information is transmitted instantaneously to other individuals included in the chat session. Instant messaging allows for real-time communication. Instructors can utilize this technology to establish virtual office hours when they will be available to answer student questions or engage subjects in an online course discussion. Since chat is an internet-based technology students and instructors need not be concerned with phone charges for this form of communication. Chats are useful for communicating across large distances with students that have internet access.

A shared whiteboard is a form of internet collaboration wherein two or more people connected to the internet at the same time can communicate through graphic images. Using drawing tools, participants are able to draw arrows, circles, and other symbols in a shared space. Additionally, it is possible to paste in images or text copied from another source. More advanced versions of this software allow users at remote sites to view others' screens and even take control of their computer. For instance, an instructor could open an Excel file on his or her computer and display it on the screen of a remote student's computer. Both student and teacher have the ability to input data and make revisions.

The main benefit of chats and whiteboards is that through their use students are able to receive immediate feedback from the instructor – something that has been historically absent in distance education. It is necessary, however, for all participants to download and install similar software and scheduling conflicts are to be expected. Chats and whiteboards combine well with all of the other technologies discussed in this section and can be used to replace more expensive forms of communication.

Web-based Resources

The increased popularity and use of the internet has been coupled with an increasing amount of online information that students and educators alike can access to improve

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[18] Ibid.

learning outcomes. Now, more than ever before, students can link to resources on the web that they once could only find in libraries or via expensive subscriptions. Teachers can take advantage of this situation and locate relevant Websites for students to review or task learners with searching the internet for information on a specific topic.

Advantages of Computer Technologies

- ❖ **Allow self-paced instruction.** Computers allow learners to proceed at their own pace, receive feedback immediately, and review as often as they like.
- ❖ **May incorporate text, graphics, audio, and video.** With the trend toward digital audio, digital video, and computer animations, it is easy to incorporate various media into computer programs.
- ❖ **Allow high levels of interactivity.** Computer technologies allow embedded questions and interactions, as well as online collaboration.
- ❖ **Provide written record of discussions and instruction.** Computer logs can easily be generated for computer interactions in distance learning.
- ❖ **Inexpensive.** With access to the Internet, it is relatively inexpensive to participate in computer technologies for distance learning.
- ❖ **Worldwide access.** The Internet can be accessed by millions of people throughout the world. There is no other way to reach so many people for so little money.[19]

Disadvantages of Computer Technologies

- ❖ **Require hardware and software.** At a minimum, a computer and Internet connection are required for most distance learning options that involve computers.
- ❖ **Generally rely on written communications.** Although it is possible to include audio and video in computer-based distance learning, most of the communications are in the form of text.
- ❖ **Require substantial planning .** E-mail and other asynchronous computer technologies require a great deal of planning and preparation on the part of the instructor.
- ❖ **Computer viruses.** If students send assignments via a computer, there is always a risk of viruses -- especially if they send programs or attached files.
- ❖ **No guaranteed performance.** Computer networks are notoriously unreliable. If students wait until the last minute to check their e-mail messages or search the Web, there is always the risk the server may be down or the Websites may have moved.[20]

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[19] Ibid.
[20] Ibid.

Guidelines for Incorporating Computer Technologies

❖ **Provide adequate structure and guidelines.** The most successful asynchronous projects include deadlines and a structure.
❖ **Provide timely feedback to participants.** Since the communications in computer-based distance learning are more impersonal than video-based delivery, it is extremely important to provide quick and relevant feedback to students.
❖ **Get to know the students.** If possible, try to meet the students, either in person or through video. In some cases, the students may be able to meet once or twice; if not, videotapes can be sent to students to increase personal communications.
❖ **Ensure sufficient technical support.** It is very important to provide sufficient technical support so that the students can get help when they need it. [21]

<u>Video Technologies</u>

Use of video technology is an effective way to add visual content to a distance education course, though some mediums can be rather expensive to implement. There are certain benefits to not only hearing but also seeing an instructor that have traditionally been lost in distance education. These include behavior modeling, demonstration, and instruction of abstract concepts. Video technologies effectively incorporate these benefits into a distance education course and are particularly useful for visual learners. There are several different media that can be utilized to transmit video to students – videotapes, DVDs, satellites, television cables, computers and microwave.

Videotape and DVD

Videotapes and DVDs are perhaps the most accessible and common formats for video delivery. Their use is quite common in countries with high rates of advanced technology consumption – such as the United States, United Kingdom, and Australia. In addition to this ease of access, video tapes and DVDs are relatively inexpensive. Further, video for these formats can be easy to record and even amateurs prove successful producers of content. Video tapes and DVDs can be used to reproduce and distribute lectures, panel presentations, and demonstrations, among others. However, they are not (usually)[22] interactive and can be costly to ship to students via the postal system.

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[21] Ibid.
[22] DVDs do have some potential for interactive media through menu screens and selection options. However, these features require specialized expertise to develop.

Satellite Videoconferencing

The closest a distance student can get to actually being there is full-motion video teleconferencing. This is one of the oldest forms of video transmission for distance education. Usually satellite offers one-way video (instructor to student(s)) and two-way audio. This technology requires two sets of equipment (or more for multi-site transmission) – the uplink dish to transmit the video and the downlink dish receiver on the student end to receive and display the signal. Its use also requires a properly wired and set up "studio" classroom – a feature that necessitates hiring a technician and other support staff. All of the equipment and expertise necessary for a satellite teleconferencing makes its utilization an expense prospect for higher education institutions. This form of video technology is recommended for transmitting courses within a network of campuses or other already established sites.

Microwave Television Conferencing

On the other hand, microwave conferencing is a less expensive alternative though its range is limited. Microwave television conferencing can be used to transmit video signals that are not more than twenty miles apart. For this type of conferencing, equipment for both transmission and reception is also needed at both sites. Thus, microwave, like satellite, may not be a viable option for classes distributed outside of a pre-established network. Further, there are a limited number of channels available for microwave conferencing and in a heavily populated area all channels may already be in use.

Cable and Broadcast Television

Another option for transmitting one-way video is through the use of existing television systems – cable or broadcast. Many large open universities have been taking advantage of this transmission medium for decades. TV can be used to transmit video to the community at large or between specific schools and branch campuses. This video technology also requires a studio for production and channels through which to broadcast. An added benefit is that many students will likely possess the capability and know-how to record television broadcast for later playback and review.

Desktop Videoconferencing and Internet Videoconferencing

For students that are equipped with computers, desktop video conferencing and internet video conferencing is possible. Equipment needed by the instructor is limited to a computer, computer camera, and microphone. This form of video conferencing is less expensive than satellite and microwave, though the quality is usually lower and a high-speed internet connection is essential for effective use. One well-known example of videoconferencing software is skype. www.skype.com

Advantages of Video Technologies

❖ **Allow both audio and video communications.** Video technologies can provide the visual and audio realism of a face-to-face class. It is generally considered the "next best thing to being there."

❖ **Facilitate personal feelings.** Video technologies enable students and instructors to see facial expressions and body language, adding personalities to communication.

❖ **Enable high levels of interaction.** Most video communications are synchronous, allowing high degrees of interactions, questions and answers, etc.[23]

Video technologies are certainly a step above audio since additional information can be conveyed visually. Teleconferencing allows students to interact with an instructor in nearly the same manner that they would be able to in a traditional classroom. Moreover, recorded video can be played back, paused, and resumed according to the schedule of the student.

Disadvantages of Video Technologies

❖ **May be expensive.** Cameras and editing equipment can be expensive. In addition, the infrastructure at each site and the links between sites can be costly.

❖ **Require a great deal of planning and preparation.** To be effective, the camera crews and the instructor must practice and become a team. Faculty members generally need practice and training to be effective in this domain.

❖ **Must be scheduled.** Most videoconferences are not spontaneous. Instead, they must be planned and the necessary resources must be scheduled.

❖ **Require technical support team.** Because of the complexity of video recording, mixing, and transmission, a technical support team is required. In addition, site facilitators are necessary to ensure the equipment works properly at the receiving stations.[24]

As noted, video technologies and satellite teleconferencing in particular, can be cost prohibitive. Additionally their use requires significantly more planning, preparation, and scheduling than audio, print, or even internet-based communications. However, when used in conjunction with other forms of technologies, for example email and print, they have the potential to fully engage a distance student in course material in a way that was once only possible through on-campus study.

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[23] Ibid.
[24] Ibid.

Guidelines for Incorporating Video Technologies

- ❖ **Avoid the "talking head."** Talking head refers to simply videotaping the instructor while she or he is talking. Instead, try to vary the camera angle, include still images of appropriate graphics, and encourage student interactions.
- ❖ **Practice with the cameras and the crew before the lesson.** It is important to plan practice times for the instructor and the camera crew. By working together, they can anticipate each other's needs and provide the best possible transmissions.
- ❖ **Encourage interactions.** Interactions can be added to video-based delivery in many ways. If the lessons are two-way, questions and other types of interactions can be included. If they are one-way video, interactions can be added through e-mail messages or the telephone.
- ❖ **Use the best cameras possible.** The old saying "garbage in; garbage out" is very true of video. The very best possible quality equipment should be used.
- ❖ **Ensure quality audio.** Losses in audio quality will be noticeable long before losses in video quality. Always ensure good recording, playback, and speaker quality. [25]

Emerging Trends in Technology

All of the technologies discussed in this section have been in use for some time. Some of those note included, such as Radio, have been in use have been in use for decades. Still others are gaining in popularity and could soon become more important to distance education delivery. For this reason their mention is warranted.

Mobile Devices

In some parts of the world cell phones and PDAs now outnumber people. Some universities have begun to explore the potential for incorporating text messaging into content delivery. The University of Pretroria in South Africa, which established its distance education department in 2002, found that in 2008, 99 percent of their students had mobile phones, as opposed to fewer than 3 percent who had internet access and fewer than 43 percent who had access to or owned a PC. The full function of a text message system there has been in place since the end of 2005. Bulk messages were sent to students to direct them to parts of their study guide, make students feel more supported by the university, send them a type of SMS quiz, and even give them a "mini-lecture" on a difficult concept. By 2007 the school had set up a system to receive and respond immediately to texts from students. The institution

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[25] Ibid.