

Open and Distance Learning Technologies for Teachers: An Overview

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ABSTRACT

The proliferation and thereby acknowledgement of ODL (Open and Distance Learning) both in developing and developed countries imply the mode's significant potential. Teaching and learning are no longer confined to the classroom or the school day. There are many technologies that can offer a great deal of flexibility in when, where, and how education is distributed. This paper provides an overview of benefits of distance learning as well as the various technologies now being used to reach remote learners and educators who are interested in implementing open and distance learning technologies in the new epoch.

Key words: Technology; Open and Distance Learning;; Teacher

Introduction

Educational opportunities at the higher education stage are not accessible to many students especially belonging to groups who are disadvantaged because of various geographical, social, cultural, economic, and linguistic or gender limitations. Viewing the increasing demand of higher education and a lot of limitations to face, it needs a serious make over to Open and Distance Learning (ODL) system which provides a viable alternative mode with the objective to take education to the door steps of the learner, enhancing social equity, and creating flexibility for lifelong learning (Koul, 2000).

Open and Distance Learning can be roughly divided into synchronous or asynchronous delivery types. Synchronous means that the teacher and the student interact with each other in "real time." For example, with two-way videoconferences, students interact with "live" video of an instructor. Less complex technologies, such as telephone conversations, are also synchronous. Asynchronous delivery does not take place simultaneously. In this case, the teacher may deliver the instruction via video, computer, or other means, and the students respond at a later time. For example, instruction may be delivered via the Web or videotapes, and the feedback could be sent via e-mail messages.

Benefits of Distance Learning

Convenience

Open and Distance learning technologies can provide convenient locations for both students and instructors. Many of the technologies, such as the Internet and telephone, are easily accessed at home. Others, such as videoconferencing, can be distributed from a single point (such as a university) to multiple remote sites (such as schools). Satellite transmissions can be viewed at specified sites, or the transmissions can be recorded for later viewing at home or school.

Flexibility

Many forms of open and distance learning provide students the option to participate whenever they wish, on an individualized basis. For example, some students may want to

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review a podcast in the middle of the night or read their e-mail during early morning hours. In addition, one student may wish to spend 30 minutes reviewing a website, while another spends an hour.

Effectiveness

Not only is open and distance learning convenient, it is also effective. Several research studies have found that distance learning is equally or more effective than traditional instruction when the method and technologies used are appropriate to the instructional tasks, when there is student-to-student interaction and when there is timely teacher-to-student feedback (Moore & Thompson, 1990; Verduin & Clark, 1991).

Affordability

Many forms of open and distance learning involve little or no cost. For example, almost all of the homes in the United States have televisions and many are connected to a cable-TV service. For these homes, it is relatively easy for the students to watch a public broadcast television show or educational documentary. In addition, almost all homes have access to a telephone and/or the Internet, enabling the use of voicemail and audio conferencing.

Multi-sensory

One of the benefits of open and distance learning is that there is a wide variety of materials that can meet everyone's learning preference -- at least part of the time. For example, some students learn from visual stimuli, such as video, and others learn best by listening or interacting with a computer program. If distance learning courses are well designed, they will likely offer learners a wide range of choices, thereby providing the optimal combinations of interaction and media.

Interactivity

Contrary to popular opinion, open and distance learning courses can offer increased interactions with students. In particular, introverted students who are too shy to ask questions in class will often "open up" when provided the opportunity to interact via e-mail or other individualized means. Through the increased interactions, teachers can better meet individual student's needs.

Equity

Educational inequity is a major issue in this and other countries. Rural schools often have less contact with educational trends, fewer qualified teachers, and more need for technology. Open and distance learning offers great potential for alleviating these issues and has been employed very effectively with geographically diverse student populations.

Connectivity Issues and Alternatives

The options for connectivity between the teaching site and the students are increasing continuously. Students can listen to podcasts while they ride their bikes or walk around the mall; cell phones provide access to the web, graphics and video; wireless networks are available at schools and stores; and Internet access in homes is available through television cables and fiber optics. Even with increased options for connectivity, the transmission speed is still an issue. The problem is that digital files (especially audio and video) are huge, and they require channels or cables with tremendous capacity to transmit quickly and effectively. The transmission capacity of a cable or a technology is referred to as the bandwidth. The greater the bandwidth, the greater the amount of digital information that can be transmitted per second. There are several options available that teachers and students can use to access the Internet, including telephone, DSL, cable, fiber, satellite, and wireless delivery. Note that although the table lists the maximum download

speeds, these speeds will seldom be realized, due to hardware limitations, latency, simultaneous users, and many other reasons. In addition, the upload speeds are often considerably less than the download speeds.

Standard Telephone Modems

The standard speed for telephone modems is currently 56 Kbps. This speed can provide effective communications via e-mail and websites that do not contain extensive graphics. Advantages of standard modems include low cost (many computers have built-in modems) and the modems' compatibility with standard telephone lines. However, access to the Internet through a standard telephone modem that transmits at 56 Kbps (or less) can be excruciatingly slow -- causing jerky movies, disjointed sounds, and long wait times for downloads.

DSL Modems

DSL stands for Digital Subscriber Line. DSL modems can transmit data to users at up to 9 Mbps. The return rate (back to the ISP or Internet) may not be quite as fast only 640 Kbps or so. In most cases, the difference in the transfer rates is acceptable for Internet access because we are most likely to receive large files from the Internet (such as graphics and video) that require the faster rates. On the other hand, we generally do not send back as much data to the Internet (perhaps an e-mail message or a click on a hyperlink). Therefore, the slower rate on the return segment is not detrimental. A major advantage of DSL technology is that it uses standard, copper telephone lines, and it is available in most areas. A DSL modem (generally supplied by the telephone company) is required, as well as an Ethernet card for your computer.

Fiber Optic Modems

Telephone companies have also installed fiber optic cables into some neighborhoods. Transmitting via fiber can be extremely fast (up to 50 Mbps). Because of the massive bandwidth that is available, the telephone company can then deliver both television and Internet (as well as regular telephone) through the same cable. For example, Verizon offers FIOS (Fiber Optic Service) to homes and businesses in many areas. Installation is required, but is usually included when you subscribe to the service. Other telephone companies offer similar services via fiber.

Cable Modems

In most areas, cable companies are offering Internet access through the same cable that delivers television signals to our homes. If your area has been configured for this service, you can connect a cable line to a network card on your computer (via a cable modem). The main advantage of cable modems is the bandwidth. Cable modems can bring data to your computer between 10 and 30 Mbps. If you have a 10 Mbps network card in a computer, you may be able to receive information up to that speed. A disadvantage of cable modems is that the transfer rate may be slowed if too many people in your neighborhood all connect to the Internet at the same time.

Satellite Delivery

It is also possible to receive information from the Internet via satellite. Satellite access is relatively fast, does not require the installation of telephone or data lines, and is not adversely affected by the number of simultaneous users. Satellite delivery, however, is usually one-way; you cannot send information back up to the satellite (not on a school budget, anyway). In most cases, a telephone line is used to send information back to the Internet or service provider, and the satellite is used to receive information. This configuration works well in most cases, because the information you send back is generally very small (a mouse click or an e-mail message); whereas, the information you receive can be quite large (video files, Web pages, etc.).

Wi-Fi (Wireless)

Wi-Fi is a wireless network that can provide access to the Internet. You can set up a wireless network within your home or school by connecting a wireless router to a DSL, cable or other connection. Computers throughout the house or school (that have a wireless receiver) can then connect to the Internet without direct wiring. Depending on the type of wireless equipment you are using, the bandwidth can be extremely fast. However, this will be limited by your connection speed. In other words if you are connecting to the Internet via a DSL modem and then setting up a wireless network, your access to the Internet will be limited by the DSL transfer rates. If you set up a wireless network, you should always be sure to include security (via a password). Otherwise, anyone with a laptop or wireless device may be able to connect to your network. More and more schools and business are offering Wi-Fi hotspots -- places where you can find Wi-Fi connectivity. Some of the hotspots (such as those at airports and cafes) may be free and open to all; others may require a password, subscription or credit card to connect.

Mobile Devices (Cellphones, PDAs, etc.)

An increasingly popular method of accessing distance learning materials is via mobile devices, such as cellphones and "personal digital assistants" (PDAs) such as Blackberries. Cellphones communicate with nearby transmitters (on cell towers), which change as the phone moves from location to location. Communicating via cellphones is by far the most mobile technology, although the speed with which data (such as websites) is transferred is not nearly as fast.

Overview of Open and Distance Learning Technologies

The various technologies used in open and distance learning can be roughly divided into four categories: print, audio (voice), computer (data), and video. Each of these categories has several subdivisions. Be aware, however, that many of the technologies overlap into more than one category. For example, though, audio conferences and videoconferences can take place using a computer and the Internet.

Print Technologies

The original form of open and distance learning was correspondence courses, in which print materials were mailed to students and returned to the teachers through the postal system. Even though there are numerous new options for distance learning, print remains a significant component of most courses.

Print materials may serve as the primary source of instruction, or they may be supplemental. As a primary source, distance students might use a textbook and read various units on a specific timetable. Other technologies, such as e-mail, could then be used to ask questions or send assignments back to the teacher.

As a supplement to instruction, text materials may take the form of worksheets or study guides that are used in conjunction with video or voice technologies. It is important to note that the supplemental print materials may be disseminated via regular mail or over the Internet. In addition, fax machines are often used to transmit the print materials back and forth between the students and the teachers. There are many advantages and disadvantages to incorporating print materials.

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.

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 skill:-* 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.

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 list serve.
- *Specify a timeline:-* Distribute a timeline for students to help them organize their study learning activities.

Audio Technologies

Audio or voice technologies offer cost-effective ways to enhance distance learning courses. The audio component of a distance learning course can be as simple as a telephone with voicemail, or it can be as complex as an audio conference with microphones, telephone bridges, and speakers.

Voicemail

Voicemail is becoming extremely common -- we are all accustomed to listening to menus of options as we try desperately to reach a real human. There is a great deal that voicemail can offer to distance learning initiatives, however. For example, voicemail:

- Allows students to leave messages for instructors regardless of the time
- Allows instructors to leave messages for individuals or groups
- Can be used to administer quizzes (this option requires some programming)
- Serves as an alternative to e-mail for those students who do not have a computer

Voicemail is generally used as a supplement to other technologies in a course. Two main advantages of voicemail are that nearly everyone has easy access to a telephone and voicemail messages can be picked up at any time of the day or night. There are disadvantages of voicemail also. For example, the length of the messages is generally limited, and a toll-free number must be provided for students who may be calling from out of the local area.

Audio Files and CDs

Audio files and CDs are inexpensive, easily duplicated, and very versatile. They can be used to deliver lectures, panel discussions, or instructions for the distant learner. Audio is especially useful in courses that require the nuances of inflection, such as foreign languages, or those that are designed for non-readers. Audio files have several advantages for the delivery of distance learning courses. Audio files are also easy to create, easy to duplicate, and easy to use. Disadvantages of audio files include the fact that they are not interactive, and they do not provide the visual elements that many students desire. When using audio files for instruction, be sure to record them using the best equipment possible. A low hiss during the recording process may result in a major distraction when the duplicate is played. Also, include print materials to enhance the audio and encourage interactions via voicemail, e-mail, fax, or other means.

Audio conferences

Telephones are one of the simplest, most accessible technologies used for distance learning. Telephone conversations can be used to mentor individual students or to reach numerous students simultaneously via a conference call (audioconference). If more than one person is at each location, audio conferences can be set up using speakerphones and telephone bridges. Speakerphones have been improved in the past few years, but they still have some limitations. Common speakerphones are called simplex message devices -- that means that people at both ends of the connection cannot talk at the same time. When one of the parties pauses, or when someone in a classroom talks loudly, the standard speakerphone switches off its speaker and activates its microphone. At this point, the voice of the distant person is cut off, and the flow reverses so that the distant person can hear what is being said in the classroom. Modern speakerphones are capable of making these simplex changes in direction so quickly that it is usually only a minor distraction. As both guest speakers and students become familiar with the limitations, they learn a pattern of brief pauses during interactive discussion to prevent interruptions.

Many telephone lines have simple conference-calling features that make it easy to connect three locations. When more than three locations must be connected, the best solution is to use a telephone bridge. The bridge is an electronic system that links multiple telephone lines and automatically balances all audio levels. The bridge can be provided through the telephone company, or it might be owned and operated by the school system. A bridge can be either call in or call out. With a call-in bridge, participants in the telephone conference are given the bridge telephone number ahead of time. The participants then call the number to connect to the call. Audioconferences are relatively easy to set up and conduct; however, it may be difficult to maintain students' interest for long periods of time without visual elements. Therefore, audioconferences used for distance learning should be short, well-planned, and supplemented with visual materials that are distributed in advance.

Podcasts

Podcasting is a method for making digital audio and video files available on the internet in such a way that others can set their computers to automatically download new episodes in a series as they are posted online. Once you tell your software to subscribe to the RSS (Really Simple Syndication) "feed", you do not need to do anything else to receive the latest episodes of your favorite podcast shows. The software will check for new episodes on a regular basis and automatically download them to your computer as soon as they become available. Even though the term podcasting originates from the words iPod and broadcasting, you do not need to own an iPod (or other type of portable player) to enjoy podcasts. All you need to do is install software on your computer that can understand the "feed" files used with podcasting. The information in the feed file tells the software where to go to find and download the files for the individual episodes that make up your subscribed podcasts. One of the most popular programs for subscribing to podcasts is Apple's iTunes. In addition, iTunes allows you to access a Podcast Directory hosted by Apple where you can

browse through hundreds of podcasts, including video podcasts intended for viewing on the newest video capable iPods, iPhones, and similar devices.

Advantages of Audio Technologies

- *Inexpensive:-* All of the audio/voice technologies are relatively inexpensive.
- *Easily accessible:* - Almost every home in the United States has a telephone. In addition, most students have access to an audiotape player in their home or in a car.
- *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!

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.

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. In most cases, it is advisable to instruct all speakers to state their name before making comments. For example, "This is Mary, and I would like to comment about..."
- *Encourage interaction:* - In an audioconference, interactions should be built into the format. For example, instructors should call on specific students, 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.

Computer Technologies

With the increased popularity of the Internet, computer technologies are receiving more and more attention as a means of delivering distance learning. The primary computer technologies used for distance education include e-mail, online collaborations, and Web-based education.

E-mail

Sending e-mail messages is a common and inexpensive way for students to communicate with instructors. In some cases, an entire distance learning course may be structured using e-mail as the only method of communication. In other cases, e-mail may be used to supplement audio or video technologies. In addition to "regular" e-mail messages, bulletin boards and listserves can also be used to conduct distance learning initiatives. Bulletin boards (also called discussion groups or newsgroups) are electronic forums where students can "post" messages or read messages that others have posted. A threaded discussion group is a bulletin board that allows students to reply to specific messages (the reply is then indented or in some way linked to the original message). Listserves are automated e-mail distribution systems. In other words, if you send an e-mail message to a listserve, it will automatically be distributed to all other members of the listserve. Many faculty members establish bulletin boards or listserves for distance learning classes to facilitate the interactions among the students.

The advantages of e-mail communications include versatility and convenience. In addition to sending straight text, most e-mail systems now allow students to attach files. That means that they can send PowerPoint files, spreadsheets, or any other type of file to each other. The convenience of e-mail is that it can be accessed at any time of the day or night. In addition, students can often obtain an e-mail account for little or no cost. Disadvantages of e-mail include the requirement to have an Internet connection and the complexity of learning to use e-mail software and attachments. Although more and more students have access to the Internet at home, it is not safe to assume that they will all have equal access. Prior to involving students in e-mail instruction, you must ensure that they all have the hardware, software, and knowledge to make the communications successful.

Online Collaboration: Internet Chat and Conferencing

E-mail communications are asynchronous, meaning that they do not take place simultaneously. However, synchronous communications are possible through online chat, shared whiteboards, and videoconferences. Online chat refers to a two-way, interactive exchange on the Internet. In chat mode, two or more people at remote computers connect to the same chat "room" and type messages. As each types his or her message, the others can see the messages on a shared screen. Online chat allows students and teachers to communicate in "real-time." For example, many instructors will establish virtual office hours, during which they will be available to chat with any students who may have questions. Because the chat takes place on the Internet, there are no phone charges to worry about!

Shared whiteboards are another form of collaboration of the Internet. If two or more people are connected to the Internet at the same time, they can communicate through graphic images on a shared whiteboard. Simple drawing tools are provided that allow them to draw arrows, circles, and other simple symbols in the shared space. In addition, one or both of them can paste in images or text that was copied from another source. Some of the more advanced software even allows users at remote sites to share applications. For example, an instructor may have Excel on his or her computer and be able to display it on a remote student's computer. The student and teacher will both be able to input data and make revisions. The advantages of online collaboration through chat or shared whiteboards are that the communications are synchronous and the feedback for the students is immediate. The disadvantages include the need for similar software at both sites and the requirement to schedule the interactions in advance. In addition, the number of participants may be limited for simultaneous collaboration.

WebQuests

WebQuest is an inquiry-oriented activity that provides an excellent example of how the various resources on the Internet can be effectively integrated for a classroom project. WebQuests are designed to guide learners as they research a specific issue and to incorporate the results of the research into an authentic product or project.

WebQuests are appealing to educators because they provide structure and guidance both for students and for teachers. The following six components are essential for implementing WebQuests.

1. *Introduction* – Background on the activity to be completed
2. *Task* – Description of main research question and anticipated end product
3. *Process* – Steps for completing the task
4. *Resources* – Websites that provide information relative to the task
5. *Evaluation* – Guidelines for evaluation (often includes a rubric)
6. *Conclusion* – Opportunities for reflection and extension

For more information about WebQuests, visit the WebQuest pages at <http://www.webquest.org/index.php> and <http://www.zunal.com/>.

Web-based Resources

The World Wide Web has opened a whole new arena for distance learning courses and the access to remote resources. The Web can be used to enhance education through remote access to resources or experts or it can be used to deliver educational programs. As an enhancement to education, teachers can locate relevant Websites for students to explore or have students conduct searches for information related to a specific topic. Bookmark files or Web pages with links can be developed to provide quick access to appropriate sites for the students. For example, Figure 9 presents a Web page that was created for the study of art. As a delivery tool, teachers can locate existing instruction on the Web, or they can create their own instruction. For example, the Blue Web'n site offers a list of tutorials that are appropriate for students in various topics and grade levels. See the Educational Technology Clearinghouse for additional resources for each subject area.

Creating Web Resources for the Classroom

There are several ways that teachers can create Web resources for their classroom, including:

- *Use a template* - Websites, such as TeacherWeb, provide templates for teachers that are completely customizable and easy-to-use.
- *Use an application program* - Almost all applications, such as Microsoft Word or PowerPoint allow the user to convert the document to a Web page simply by selecting *Save As... Web Page*.
- *Use a Web editor* - Programs such as DreamWeaver and Nvu are designed to create Web pages. They provide a WYSIWYG (what you see is what you get) interface. Dreamweaver is commercial program by Adobe, while *Nvu* is a free program.
- *Create a Web pages by hand* - Web pages consist of HTML code, which can be typed into NotePad or other text editors. See Making the Connections for specific instructions on using HTML.

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.

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.

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-* In a perfect world, the computer and the technology would be invisible to the students. It is very important to provide sufficient technical support so that the students can get help when they need it.

Video Technologies

The ability to see and hear an instructor offers opportunities for behavior modeling, demonstrations, and instruction of abstract concepts. Video techniques for distance learning are often characterized by the transmission media (videotapes, satellites, television cables, computers, and microwave). Each of the media can be described as it relates to the direction of the video and audio signals -- one-way video; two-way video; one-way audio; and two-way audio

Videotape and DVD

Videotapes and DVDs offer popular, easy-to-use formats for instructional materials. Almost all students have access to a videotape or DVD player in the homes, and they are also common at school. Videotapes and DVDs have several advantages for the delivery of distance learning. In addition to easy access to the

hardware, the tapes and discs are quite inexpensive. If a video camcorder is available, video is relatively easy to record (although professional staff and equipment provide in a much better product than will an amateur production team). Disadvantages of videotapes and DVDs include the fact that they are not interactive. In addition, they can be costly to send via the mail.

Satellite Videoconferencing

Full-motion video teleconferencing (referred to as videoconferencing) offers the "next best thing to being there." Satellite transmission is one of the oldest, most established techniques for videoconferencing. In most cases, satellite delivery offers one-way video and two-way audio. Two sets of equipment are needed for satellite systems. The uplink (a large satellite dish) transmits the video and audio signals to the satellite. The downlink (a small dish antenna) receives and displays the signals. When satellite videoconferences are used for distance learning, a studio classroom must be properly wired for the lighting, microphones, and cameras needed to produce an acceptable lesson. The cameras are usually connected to a control room, where one or more technicians control the signals. The resulting television signal is then sent to the uplink transmitter. Uplink transmitters are very expensive and are often shared with other schools or businesses.

The receiving sites of satellite videoconferences (in most cases other schools) must have satellite downlinks. These dishes select, amplify, and feed the signals into the classrooms, where they can be displayed on standard television monitors. To provide two-way audio with interactions from the remote classrooms back to the teacher, a telephone bridge is usually employed. Satellite videoconferencing can be very expensive. It may not be cost-effective for most school systems to use uplinks to originate distance-education classes unless the school systems were in a position to market the classes over wide geographic areas. It is reasonable, however, for a school to use a downlink to receive commercial courses that are delivered through satellite channels.

Microwave Television Conferencing

Satellites are a popular method for enabling video communications over long distances. Microwave transmissions provide a cost-effective method for videoconferencing in more localized areas. Most microwave systems are designed to transmit video signals to areas that are not more than 20 miles apart. The most common microwave systems use frequencies that have been designated by the Federal Communications Commission (FCC) as Instructional Television Fixed Service (ITFS) stations. When compared with satellite or commercial broadcast television, ITFS stations operate at a lower power, and the transmission equipment is relatively inexpensive. Reception equipment is also reasonably priced, as long as the receiving sites are located within 20 miles of the transmitter and there are no hills or tall buildings to block the line-of-sight signal. One drawback of microwave ITFS communication involves the limited number of channels available in any one area. Many metropolitan areas already have all available channels in use, so no further expansion of ITFS teleconferencing is possible in these areas.

Cable and Broadcast Television

Cable and public broadcast television have been used to distribute instruction for years. In addition to the educational networks, almost all public cable television systems allow schools to transmit television courses. This type of connection can be used to transmit one-way video and one-way audio to the community at large or between specific schools. For example, if two area high schools do not each have enough students to justify an advanced math course, they might team up to teach a single course delivered through cable television. In one school, the teacher would conduct a regular class; in the other school, the students would watch and listen through a standard cable television channel. Open and distance distance learning through cable television systems requires both a studio and channels through which to broadcast.

The cost depends largely on the "partnership" offered by the cable or broadcast system. Even though the broadcast will take place at a scheduled time, research shows that the majority of the students will record the program and play it back at a convenient time.

Desktop Videoconferencing

Desktop videoconferencing uses a computer along with a camera and microphone at one site to transmit video and audio to a computer at another site or sites. The remote sites also transmit video and audio, resulting in two-way video and two-way audio communications. Although desktop videoconferencing is considerably less expensive than satellite or microwave systems, there are a couple of limitations. First, the images are usually transmitted at 15 images per second, half the normal video speed. This causes the video to appear somewhat jerky if any rapid motion takes place. A second concern is related to the connection between the computers. Most systems are connected either through local area networks (LANs) or through relatively fast connections.

Internet Videoconferencing

It is also possible to conduct videoconferences over the Internet. You need a video camera and digitizing card/camera to transmit video signals as well as a microphone and speakers/headset. Internet videoconferencing usually results in a small image, which may be jerky (a few frames per second), depending on the speed of the Internet connection. In most cases, a regular modem is far too slow to transmit effective video.

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.

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.

Guidelines for Incorporating Video Technologies

- *Avoid the "talking head"-* "The early days of distance education witnessed the inclusion of the worst aspects of the old passive/lecture paradigm, which were even more deadly from a distance than in person" (Parker, 1997). 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 speak quality.

Implementing Open and Distance Learning

The implementation of open and distance learning technologies requires careful planning. Which illustrates the major phases in the implementation process.

1. Conduct Needs Assessment

The needs assessment or analysis phase consists of four parts: course analysis, audience analysis, instructor analysis, and technology analysis.

Course analysis- The course analysis seeks to identify content areas that could be enhanced, expanded, or initiated through distance learning techniques. Begin by examining the instructional needs that are not being met and determining if distance learning could contribute. Potential areas could include courses that have a high demand, but few instructors; courses that are needed in geographically diverse locations; courses that would benefit from remote experts; and courses that could address special needs, such as homebound students.

Audience analysis- Distance learning techniques are not appropriate for all students. In most cases, a great deal of motivation and the ability to work in a self-paced environment are essential. You should carefully examine the locations of the students also. For example: Will the instruction be delivered to schools or to homes? Can the students read? What are their learning styles? Is supervision required?

Instructor analysis- With distance learning, facilitators and technical support teams are also necessary. For example, there may be a "teacher" who delivers the lesson via a videoconferencing system. The class is then sent to several schools throughout the area, and remote students participate. At each site, however, supervisors must be in the room with the students; technical support staff must make sure that the equipment is functioning.

Technology analysis- As outlined earlier there are many different technologies that can be used to deliver distance learning. Selecting the most appropriate technology depends on the content area, the learning styles of the students, and the existing hardware and software. For example, foreign language instruction requires an audio component, and Web-based education is impossible if the students do not have access to a computer.

The geographic locations of the teachers and students can also impact the technology solution.

2. Outline Instructional Goals and Objectives; Produce Instructional Materials

A well-structured distance learning course must place instructional objectives foremost. The technology should be as invisible as possible -- just another tool that teachers can use to effectively convey the content and interact with students. After the goals and objectives are outlined, the instructional materials can be designed and developed. It is important not to underestimate the commitment required for this step --

creating effective materials for distance learning is an extremely time-consuming and energy-consuming process. Regardless of whether the technology is audiotape or satellite video, ample time must be allocated to ensure that the materials are accurate, appropriate, and structured to maximize the benefits for distant students and to minimize the limitations.

3. Provide Training and Practice for Instructors and Facilitators

Many of the techniques and skills used in a classroom teaching situation do not translate directly into a distance education approach. Teacher training programs are important to acquaint the teachers with the use of technology as well as to help with the re-design of the instructional strategies. In particular, most teachers need assistance and practice with:

- Effective strategies for implementing small group activities and individual practice
- Techniques for maximizing teacher/student and student/student interactions
- Successful approaches for integrating technology into the teaching/learning process
- Tactics for motivating students at a distance

Facilitators and support personnel are also crucial to successful distance learning experiences. If students are located at remote sites, facilitators will likely be the on-the-spot contacts for the students. It is important that they are fully integrated into the course and communicate frequently with the instructor. In addition, support personnel are important for both the instructor and the students to ensure that the technology functions as it should and does not cause undue frustration.

4. Implement the Program

After the training is complete and a pilot test has been conducted to ensure the technology is functioning, the program can be implemented. One important factor to keep in mind is the need to include structured activities. Timelines, deadlines, and feedback help to motivate students and provide the framework the students need to function in a flexible environment. Another important aspect to keep in mind during the implementation phase is the need to emphasize interactions. Research strongly supports the need for interaction in distance learning initiatives. "Programs need to include methods for receiving feedback, providing help, and creating a sense of belonging" (Parker, 1997). Students of all ages respond positively when they know someone cares.

5. Conduct Formative Evaluation

Formative evaluation takes place throughout the development and implementation. At each step of the way, instructors and administrators should stop and review. In addition to querying the students, ask others who have implemented similar programs to assess the approach. Make revisions as often necessary.

6. Conduct Summative Evaluation

Summative evaluations take place after the instruction is completed and provides data for future planning (Willis, 1995). Evaluations can be conducted through surveys, achievement tests, interviews, or other methods. Careful analysis of summative evaluations can be used to identify both strengths and weaknesses of the distance learning course, content, and approach.

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