A Teacher's Guide to Distance Learning

February 2000

Florida Department of
Education

www.firn.edu/doe

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A Teacher's Guide to Distance Learning

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. A Teacher's Guide to Distance Learning is intended for K-12 educators who are interested in implementing distance learning technologies. It provides an overview of the advantages and characteristics of the various technologies now being used to reach remote learners.

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A Scenario

Michele was very upset when she first learned that she would not be able to attend school for several months due to her illness. She dreaded the isolation of being at home, and she wanted desperately to keep up with her peers so that she could graduate from high school on schedule.

Luckily, Michele's teachers and parents worked out a plan that incorporated distance learning. With a computer, a telephone line, and a television at home, she was able to keep pace with her peers. Michele took Algebra from a Virtual High School on the Internet; she continued to study History with her classmates through a speaker phone and e-mail; and she sent audiotapes and videotapes back and forth to her Spanish teacher to practice her dialogues. She even managed to see and hear her classmates through scheduled videoconferences on the Internet.

Although the distance learning techniques enabled Michele to keep up with her class, the implementation was challenging for all involved. The principal and counselor had to devote the time and energy necessary to locate courses in the Virtual High School that would meet the district's requirements. Her teachers were required to adapt some of their materials for individualized learning, and her parents had to spend extra time helping Michele schedule her studies and her medical appointments. They all agreed, however, that the results were well worth the efforts—Michele was back at school now and would graduate on schedule with her classmates!

Section I
Definition of Distance Learning

There are many synonyms used for Distance Learning, such as Distance Education, Distributed Learning, or Remote Education. For the purposes of this booklet, Distance Learning will be defined by the following criteria:

1. The teacher and students are separated by distance (this distance could mean different classrooms in the same school or different locations thousands of miles apart).

2. The instruction is delivered via print, voice, video, or computer technologies.

3. The communication is interactive in that the teacher receives some feedback from the student. The feedback may be immediate or delayed.

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. Common synchronous and asynchronous technologies are outlined in Figure 1.

	Synchronous	**Asynchronous**
Video	Videoconferencing	Videotape, Broadcast video
Audio	Audioconferencing	Audiotape, Radio
Data	Internet chat, Desktop videoconferencing	E-mail, CD-ROM

Figure 1. Common synchronous and asynchronous technologies.

Section II
Applications in K-12 Education

Distance learning applications in higher education and industry are growing at a rapid pace. It is now possible to obtain a college degree without physically attending a traditional class. Likewise, numerous companies are using distance learning technologies to distribute training courses to employees on a worldwide basis.

Distance learning in K-12 education is not as prevalent as it is in the adult world due to the need to supervise young students. There are, however, many forms of distance learning that are becoming increasingly common in schools throughout the world. The K-12 applications for distance learning include:

- Instruction for Homebound Students
- Virtual High Schools
- Instruction for Distributed Classes
- Interactions with Outside Experts
- Mentoring and Tutoring of Distant Students
- Collaborative Projects
- Access to Remote Resources
- Staff Development Programs

Instruction for Homebound Students

Distance learning technologies offer a variety of options for students, who, for one reason or another, are unable to attend school. There are many options for meeting the needs of the homebound students. For example, videotapes can be sent of classes, Internet connections can be established for e-mail and conferencing, or two-way interactive video systems can be installed.

Example:

Mr. James is teaching a class with four students—and all four are confined to their homes. Through a project organized by his school district, he is able to communicate with his students through computers and telecommunications. In particular:

• The students send in their work via e-mail so that Mr. James is assured that the students have organized their thoughts prior to class discussion.

• Mr. James gathers updated materials (e.g., newspaper and magazine articles) and sends them to the students via e-mail.

• The students also participate in their own group conference so that they can share pertinent materials with each other (Kantaras, 1993, 49).

Virtual High Schools

Students do not have to be homebound to benefit from distance learning technologies. Some high schools are experimenting with offering credit courses for students who are home schooled—those who have dropped out of high school, those in juvenile detention institutions, and those who need the flexibility to "attend" school at times other than 7:00 am to 3:00 pm. Virtual high schools can offer the flexibility that appeals to certain students in specific circumstances, while maintaining high standards for education.

Example:

Paul needed to re-take American History so that he could graduate from high school with his classmates. The problem was that he also had to report to work at 3:00 each afternoon, and there was no time during the school day to take the course. His counselor suggested that he connect to the Internet and check out the Florida High School at http://fhs.net. The Florida High School is a joint project between Orange and Alachua County public schools (see Figure 2). The "virtual" school curriculum currently includes Chemistry, Algebra, Basic, Pascal, SAT Preparation, Economics, American History, and over 30 other courses. (Any Florida student may take the courses without charge.)

Figure 2. Screen print from http://fhs.net.

Instruction for Distributed Classes

A number of school districts, particularly in less-populated areas, are using distance learning technologies to share teachers among several schools. For example, if only a few students in each school need a course, they can comprise a single class large enough to justify the cost of a teacher. Distributed classes via distance learning may help alleviate the predicted shortage of teachers in K-12 schools. According to United States Department of Education projections, two million new teachers will be needed in the next decade. These shortages are predicted to be especially acute in the areas of science and mathematics.

Example:

Ms. Susan Williamson is teaching a Calculus lesson from her studio in Alaska and beaming it up to a satellite. Her students are scattered all over the Northwest in over 100 schools. Through satellite downlinks at each school, they can see and hear their teacher. If they have immediate questions, they can call her during the class period. Otherwise, they can send individual questions to Ms. Williamson through e-mail or fax. Proctors and teacher's aides supervise the students in the remote classrooms, distribute learning materials, and administer tests.

Interactions with Outside Experts

Technologies such as videoconferences, audioconferences, and the Internet allow teachers to bring into the classroom a guest who would normally be unable to visit. Long distances, difficult travel conditions, or busy schedules make it impractical for many individuals to visit school classrooms as guest speakers. Prominent persons are usually more willing to take 15 minutes to talk with a class by telephone or videoconference than they are to spend a couple of hours traveling to and from the school. In addition, there are numerous Web sites that offer access to experts.

Example:

Mr. Reynolds' team of students and teachers was just embarking on an interdisciplinary study of Mars when he learned that a well-known science fiction author lived in town. The author was very interested in education, and agreed to become an advisor to the students as they investigated far-off worlds. In Language Arts classes, students wrote science fiction stories with the author's guidance. He held an audioconference with the student authors to help them develop story ideas, then did some editing via e-mail and chat. The Math and Science classes designed Mars research stations that were judged by a local team of experts. The engineers and the students used videoconferencing to display and discuss the projects.

Mentoring and Tutoring of Distant Students

Some school systems have implemented distance learning technologies to provide students access to tutors during the early evening hours or on weekends. Depending on the system, the tutors can work at their own homes or at a central location, such as the school, to mentor the remote students. Cross-age mentoring is also possible with older students helping younger students by means of distance learning.

Example:

Anita had always dreamed of becoming an astronaut, and thanks to a distance learning project, she now knows how to make her dream come true. When an astronaut visited her school district, the local educational channel arranged for an interactive, live broadcast to area classrooms. Through the broadcast, Anita learned about the astronaut training program.

Students, including Anita, faxed, e-mailed, and called in questions to the TV studio for the astronaut to answer. After the broadcast, the teacher accessed NASA's Web site to find out more about the astronaut program. When the students thought of more questions, they began an on-going electronic dialogue with their new mentor by e-mailing him at NASA.

Collaborative Projects

Distance learning can also be used to enhance collaboration between students in remote classrooms. There are many projects on the Web that promote problem solving, multicultural education, and community involvement. In most cases, one teacher or organization serves as facilitator for a project. As the data is collected from the remote schools, the facilitator compiles it and disseminates the results.

Example:

Ms. Romero's class was beginning a unit on conservation and the environment. In order to make the lesson more authentic, she decided to participate in the Save the Beaches project she had seen on the Internet. Through this project, her students could collaborate with students all over the world as they explored their environment. Specifically, they would visit local beaches, collect the data, then analyze it and share the data with the other students (Save the Beaches, 1998). (For more information, visit the Save the Beaches site at http://ednhp.hartford.edu/www/Nina/.)

Access to Remote Resources

K-12 schools are often isolated from other learning environments, such as universities, museums, and libraries. Through distance learning technologies, these resources can become available for students in both urban and rural areas.

Example:

Town High School's art classes learned that the city was redesigning and updating the local art museum. The students had plenty of ideas of their own, but they needed more information on how to contribute their ideas to the remodeling project.

Some of the students accessed the city government Web pages to learn about the schedule and procedure for providing input about the museum. Another group found Web sites for museums, including the Louvre, Prado, National Gallery of Art, and the Museum of Modern Art. This group did comparisons and evaluations of the virtual art museums, which became a guide to use in making recommendations to the city.

A third group contacted other schools and cities to ask about art museums around the country. Finally, the students at Town High addressed the city council with their findings, and offered to help create a Web site for the newly designed museum.

Staff Development Program

At the end of long days in the classroom, it is difficult for teachers to drive to a university or other facility for inservice credit or to pursue an advanced degree. Through distance learning technologies, the staff development programs can be delivered to the teachers' school or home. Some universities offer entire Master's and Doctoral programs via distance learning.

Example:

Ms. Brown enjoyed both her position as a third grade teacher and her "job" as a mother of two small children. Through the Learn From A Distance program at USF, she was also able to attend college and work on her Master's degree. The courses were offered through the Internet, and she was able to work at the time, place, and space that was best for her.

Benefits of Distance Learning

Distance learning technologies offer a myriad of benefits for K-12 education, including convenience, flexibility, effectiveness, and efficiency.

Convenience

Distance learning technologies can provide convenient locations for both students and instructors. Many of the technologies, such as the Internet, videotape, and telephone, are easily accessed at home. Others, such as desktop 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 videotaped for later viewing at home or school.

Flexibility

Many forms of distance learning provide students the option to participate whenever they wish, on an individualized basis. For example, some students may want to review a videotape 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 Web site, while another spends an hour.

Effectiveness

Not only is distance learning convenient, it is also effective. Several research studies have found that distance learning is equal to 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). In a study conducted at California State University, students who participated in a Web-based course achieved significantly higher test scores (Schutte, J. G., 1996).

Affordability

Many forms of distance learning involve little or no cost. For example, over 99% of the homes in the United States have televisions and 65% are connected to a cable-TV service (Casey, Dager, & Magel, 1998). For these homes, it is relatively easy for the students to watch a videotape or a public broadcast television show. In addition, almost all homes have access to a telephone, enabling the use of voicemail and audioconferencing.

Multi-sensory

One of the benefits of 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, 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 (Franklin, Yoakam, & Warren, 1996). Through the increased interactions, teachers can better meet an 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. Distance learning offers great potential for alleviating these issues and has been employed very effectively in Canada and Australia—two countries with geographically diverse student populations.

Section IV
Connectivity Issues and Alternatives

A major concern for distance learning is the connectivity and transmission speed between the teaching site and the students. Some distance learning technologies use analog transmissions and some use digital. Traditional distance learning techniques (such as telephone and videotape) are analog (represented by a continuous waveform). Newer technologies (such as the computer and desktop videoconferences) are digital (represented by binary codes of zeros and ones).

The trend is to move toward primarily digital systems. The problem is that digital files (especially audio and video) are huge, and they require "pipes" 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.

Access to the Internet through a standard modem that transmits at 28,800 bits per second (28.8 Kbps) can be excruciatingly slow—causing jerky movies, disjointed sounds, and long wait times. There are several options available now or in the near future that will help to expand the bandwidth and increase the speed of information transfer. These options include ISDN lines, T1 lines, ADSL modems, cable modems, and satellite delivery.

Standard Modems

The "standard" speed for modems is currently between 28.8 Kbps and 56 Kbps. Those speeds can provide effective communications via e-mail and Web sites that do not have extensive graphics. Advantages of standard modems include low cost and compatibility with standard telephone lines.

Although the bandwidth and speed of modems continues to improve, they are far too slow for most video applications. In addition, two modems of different speeds will communicate at the slower of the rates. For example, if you have a 56 Kbps modem, but your Internet Service Provider (ISP) has 28.8 Kbps modems, you will only be able to communicate at 28.8 Kbps. Other factors, such as the amount of congestion on the Internet, also affect the transmission rate.

ISDN

ISDN stands for Integrated Services Digital Network. It is a totally digital system designed to transmit information faster than standard modems. ISDN is often used for desktop videoconferencing or Internet access. A single ISDN line with two channels can transmit data at 128 Kbps (about five times faster than a regular modem). ISDN telephone lines use interface devices (called ISDN terminal adapters or ISDN modems) to connect to computers (see Figure 3).
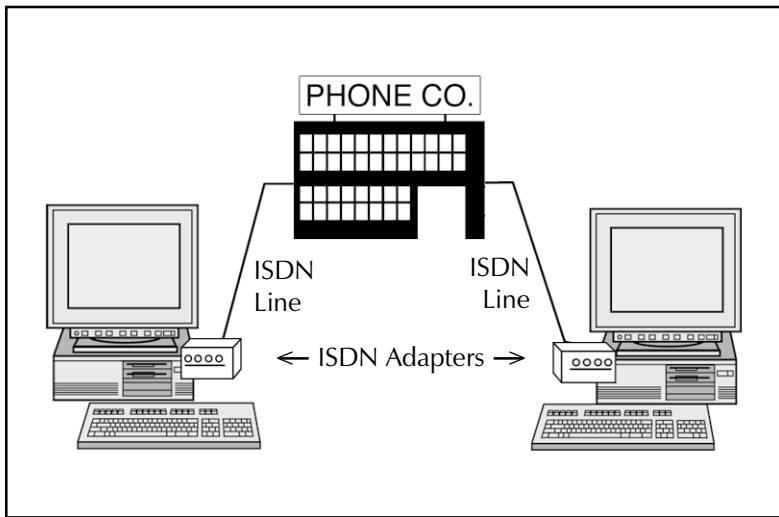
Figure 3. ISDN connections.

ISDN has great potential for distance learning because it can use the copper telephone wire system that is currently in place. To implement ISDN on a large scale, however, telephone companies need to upgrade their switching equipment, and homes and schools need to upgrade their telephones and computer interfaces.

At present, ISDN availability and costs vary dramatically. In some areas, ISDN lines are available for nearly the same cost as standard voice lines, but, in other areas, they are either very expensive or unavailable. When checking on the price of an ISDN connection, be aware that some systems require a connection fee, a monthly fee, and a charge per minute.

T1 and T3 Lines

A standard T1 line (also referred to as DS1) allows digital information to be transmitted at 1,544 Kbps (1.544 Mbps). This transmission speed is almost 54 times faster than a 28.8 Kbps modem. Because T1 lines can be quite expensive to lease, many schools lease a "fractional" T1 line through which they have access to a portion of the bandwidth.

T3 lines (also referred to as DS3) are even faster than T1 lines. The T3 lines can transmit data at 44.736 Mbps. This is roughly equivalent to 29 simultaneous T1 lines. T3 lines are extremely expensive. In most cases, T3 lines are used to connect parts of the Internet backbone or to connect supercomputers at government and research sites. Both T1 and T3 lines can support video, audio, and data transmissions.

ADSL Modems

ADSL stands for Asymmetric Digital Subscriber Line. ADSL modems can transmit data to users at up to 9 Mbps. The return rate (back to the ISP or Internet) is not quite as fast—only 640 Kbps. In most cases the slower rate on the return segment is not detrimental for Internet access. 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).

A major advantage of ADSL technology is that it uses standard, copper telephone lines; however, the telephone lines in many areas need to be upgraded to allow the rapid transmission of data. Several companies, including Bell Atlantic, Pacific Bell, and GTE are promoting ADSL and charge approximately $100 per month. An ADSL modem is required as well as an Ethernet card for your computer.

Cable Modems

In some 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.

The main advantage of cable modems is the bandwidth. Cable modems can bring data to your computer at roughly 400 times faster than a regular modem. If you have a 10 Mbps network card in a computer, you may be able to receive information at that speed. As illustrated in Figure 4, cable modems offer one of the fastest technologies available for Internet access (PC Magazine, April 22, 1999).

Technology		Speed
28.8 Modem	|	28.8 Kbps
ISDN	▮	128 Kbps
Satellite	▮	400 Kbps
T1	▬	1.5 Mbps
ADSL	▬▬▬	9 Mbps
Cable Modem	▬▬▬	10 Mbps
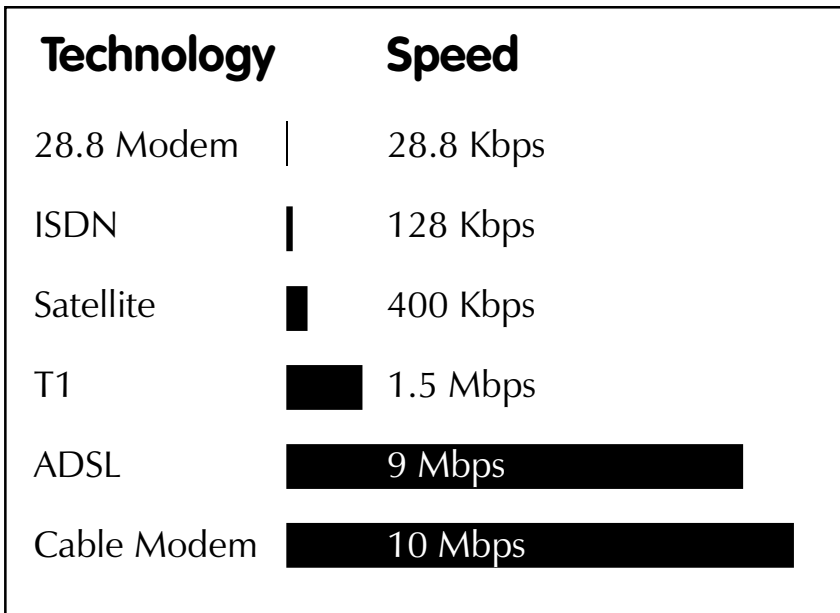
Figure 4. Comparison of sample transfer rates.

Even though cable modems are faster than most other technologies, they are not the most expensive. The relative expenses for monthly use of the various technologies are illustrated in Figure 5.

Technology	Monthly Cost	Price Kbps/month
28.8 or 56 Modem	$20	.36-.69
ISDN	$20	.16
Satellite	$30	.075
T1	$1500	1.00
ADSL	$40	.004
Cable Modem	$40	.004

Figure 5. Comparison of approximate monthly fees. (Feeley, 1997).
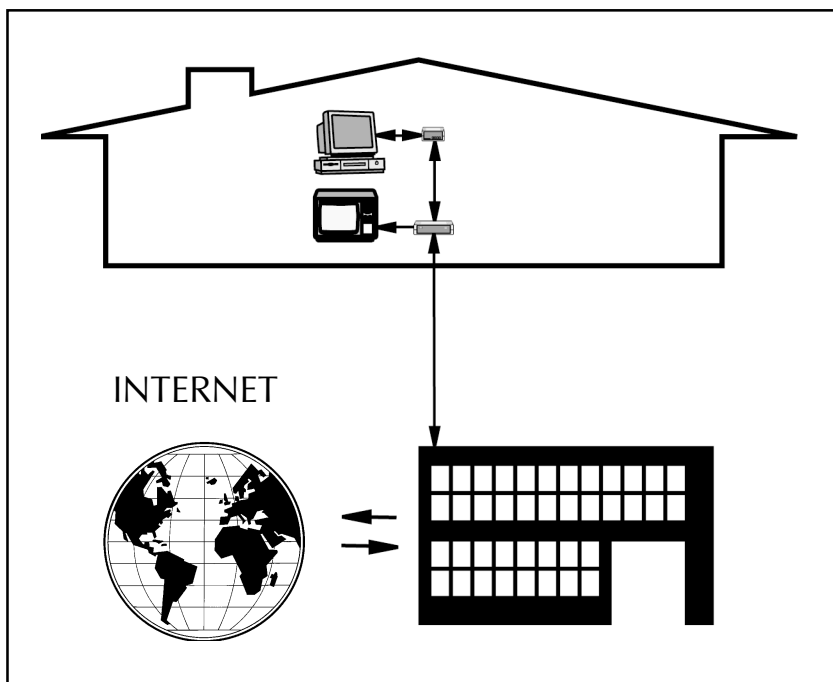
Figure 6. Cable modem in a home.

Disadvantages of cable modems are that you must have a computer with a network card and you must purchase a cable modem (see Figure 6). In addition, the transfer rate may be slowed if too many people in your neighborhood all connect to the Internet at the same time. Although this technology is new and the standards for cable modems are not firmly established, cable modems offer great potential for high-speed access to the Internet for schools and homes.

Satellite Delivery

It is also possible to receive information from the Internet via satellite. Satellite access is relatively fast, and is not adversely affected by the number of 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 (see Figure 7). 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.).
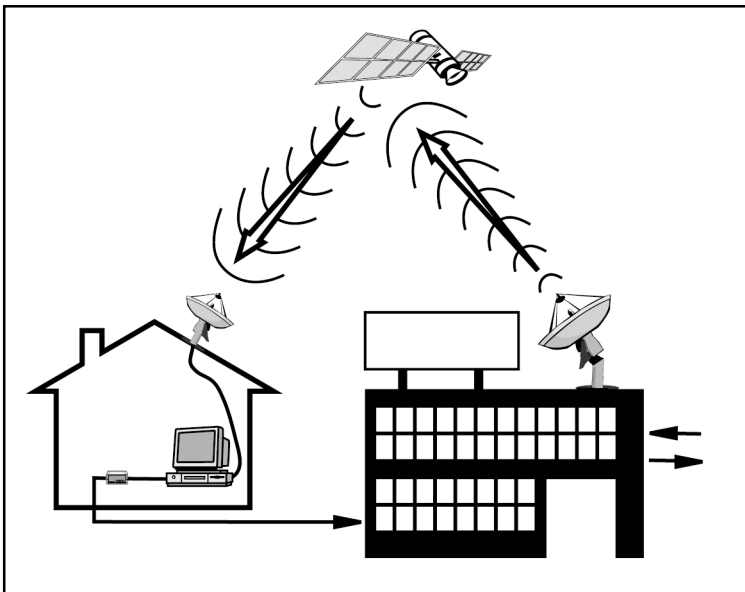
Figure 7. Connecting to the Internet via satellite.

Section V
Overview of Distance Learning Technologies

The various technologies used in 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, though, that many of the technologies overlap into more than one category. For example, audioconferences and videoconferences can take place using a computer and the Internet. The basic technologies are illustrated in Figure 8. Sections 6-9 of this booklet provide advantages, disadvantages and guidelines for each technology.

Print:
Textbooks
Study guides
Workbooks
Fax

Computer:
E-mail
Web-based courses
Videoconferences
CD-ROM
Collaboration software

Voice/Audio:
Telephone
Voicemail
Audioconferences
Audiotape
Radio

Video:
Videotape
Satellite delivery
Microwave
Broadcast video
Desktop video
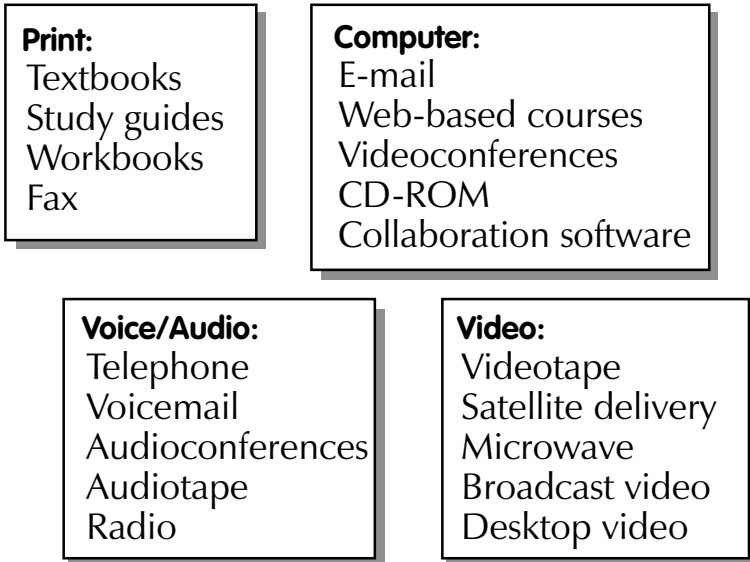
Figure 8. Distance learning technologies.

Section VI
Print Technologies

The original form of 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 many 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 according to 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 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 bet ween 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. Students need to know exactly which print materials they are responsible for reading.

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. It may take days or weeks for printed matter to travel between student and teacher.

Audio Technologies

Audio 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 audioconference with microphones, telephone bridges, and speakers. (Audioconferences via a computer will be discussed in Section VIII: Computer Technologies.)

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 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.

Audiotapes

Audiotapes (cassettes) 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.

Audiotapes have several advantages for the delivery of distance learning courses. First, they are very inexpensive and readily accessible. Almost all students have access to a cassette player in their home, school, or car. Audiotapes are also easy to create, easy to duplicate, and easy to use. Disadvantages of audiotapes include the fact that they are not interactive, and they do not provide the visual elements that many students desire.

When using audiotapes 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 tapes and encourage interactions via voicemail, e-mail, fax, or other means.

Audioconferences

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, audioconferences can be set up using speakerphones and telephone bridges (see Figure 9). 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.
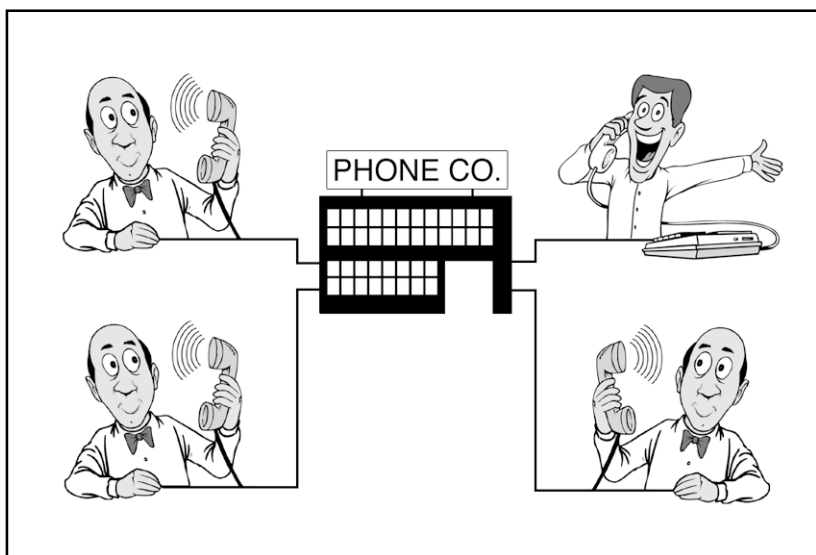
Figure 9. Audioconference using a telephone bridge.

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 is it 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. For example, South Carolina conducted teacher training with hundreds of teachers by providing a toll-free telephone number and specific times for teachers to call into the conference. A call-out bridge arrangement requires a person, usually an operator, to dial the telephone numbers of all the locations that will participate in

the conference. As each number is reached, it becomes connected 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.

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.

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 audioconfer- ence, 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 to students who were unable to participate in the conference and to 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

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.
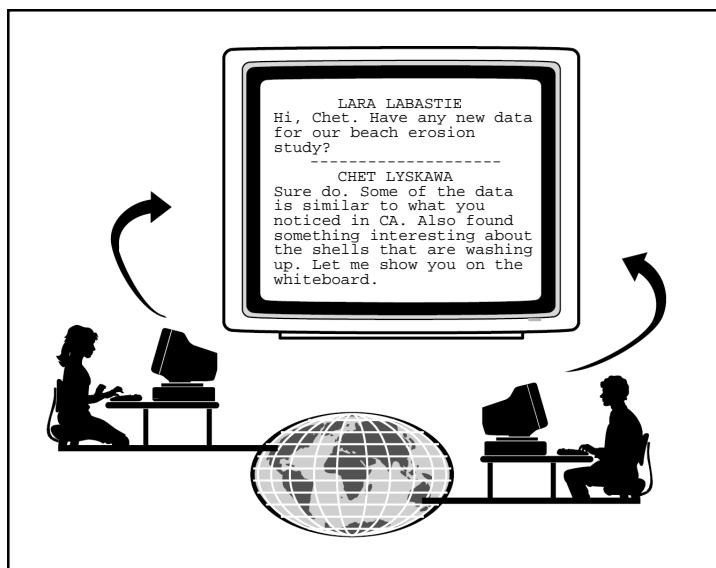
Figure 10. Chat screen.

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 (see Figure 10). 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 (see Figure 11). 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 copied from another source. Shared whiteboards require special software (such as CU-See Me or Net Meeting). 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.

Figure 11. A shared whiteboard in use.
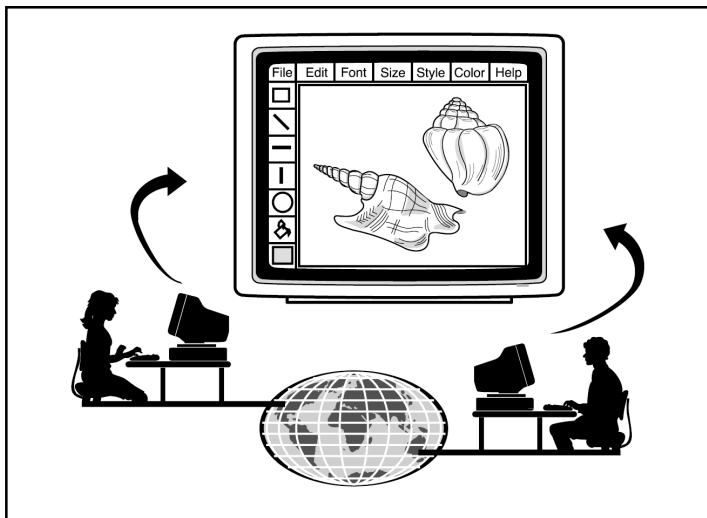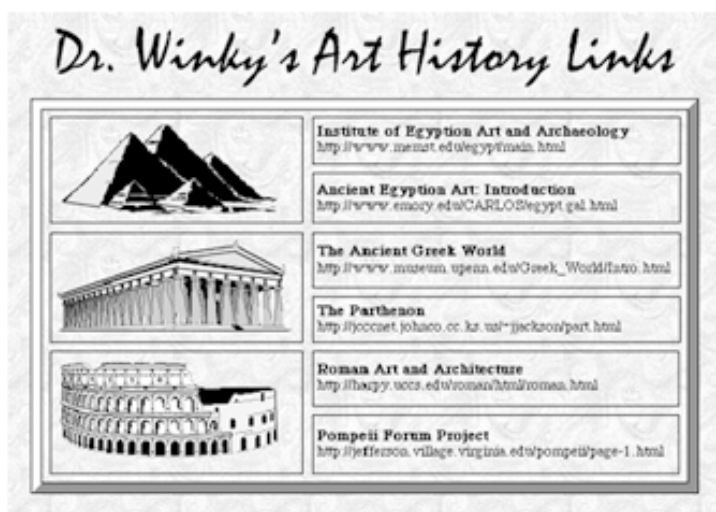
The advantages of online collaboration through chat or shared whiteboards are that the communications are synchronous and the feedback for the students is immediate. The disadvantages include the need for similar software at both sites and the requirement to schedule the interactions in advance. In addition, the number of participants may be limited for simultaneous collaboration.

Web-based Education

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 Web sites 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. A teacher created the following Web page for the study of art history.

Dr. Winky's Art History Links

	Institute of Egyption Art and Archaeology http://www.memst.edu/egypt/main.html
	Ancient Egyption Art: Introduction http://www.emory.edu/CARLOS/egypt.gal.html
	The Ancient Greek World http://www.museum.upenn.edu/Greek_World/Intro.html
	The Parthenon http://ccenet.johnco.cc.ks.us/~jjackson/part.html
	Roman Art and Architecture http://harpy.uccs.edu/roman/html/roman.html
	Pompeii Forum Project http://jefferson.village.virginia.edu/pompeii/page-1.html

There are also numerous Web sites that provide access to experts. These "ask-an-expert" pages

allow access to experts in many different fields. In most cases, the experts will answer questions via e-mail or the Web page in less than two weeks (see Pitsco's Ask An Expert at http://www.askanexpert.com/askanexpert/).

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 at http://www.kn.pacbell.com/wired/bluewebn/ offers a list of tutorials on various topics that are appropriate for students at all grade levels.

There is also a great deal of instruction on the Web that is designed for K-12 teachers. A Teacher's Guide to the Holocaust provides over 1,000 Web pages, 700 images, VR movies, original plays, student activities, and links to relevant Holocaust sites for teachers to use in the classroom (see Figure 12).

Figure 12. A Teacher's Guide to the Holocaust.

Additional sites designed for student and teacher education are provided in Figure 13.

Educational Space Simulations Project
http://chico.rice.edu/armadillo/Simulations/

Eyes on Art
http://www.kn.pacbell.com/wired/art2/index.html

Foreign Languages for Travelers
http://www.travlang.com/languages/

Gamelan (Wide array of lessons and programs in Java)
http://www.gamelan.com/

The Heart: An Online Exploration
http://http://sln2.fi.edu/biosci/heart.html

HTML Tutorial
http://fcit.coedu.usf.edu/htmltutorial/

Interactive Projects at the Curry School of Education
http://curry.edschool.virginia.edu/curry/about/Interactive.html

MEGA Mathematics
http://www.c3.lanl.gov/mega-math/

Newton's Apple (Multiple programs about science)
http://ericir.syr.edu/Projects/Newton/

Odyssey in Egypt: Interactive Archaelogical Dig
http://www.scriptorium.org/odyssey

School Networks: A Primer for Teachers
http://fcit.coedu.usf.edu/network/

Virtual Frog Dissection Kit
http://george.lbl.gov/ITG.hm.pg.docs/dissect/info.html

Figure 13. Instructional Web sites

It is also possible to offer entire courses via the Web. There are several Virtual High Schools or CyberSchools that are offering credit courses for students. These programs are designed specifically for students who need or want the flexibility of taking courses whenever and wherever it is convenient.

If teachers want to create their own lessons for delivery on the Web, they can use HTML or one of the HTML editors, such as FrontPage, Netscape Composer, or PageMill. Recently, several courseware management tools have also appeared on the market. These programs are designed to allow teachers to quickly place syllabi, activities, and instruction on the Web. In addition, they provide access to bulletin boards, chat rooms, and e-mail. Student passwords help to keep student records secure.

WebCT, TopClass, Web Course in a Box, and Learning Space are examples of Web course management software. These programs are similar in design and structure, and they are quite easy to use. First, the software must be installed on a Web server at a school. Then, the instructor creates an online class by entering the names of the students and the appropriate instructional materials. When the course is ready, a student can access it from any Web browser, sign-in with a password, and view the instructional materials. Students can leave messages for each other or for their instructor and they can participate in online chat sessions (see Figure 14).

Telecommunications in Education

Syllabus

Activities
assignments

IT Home Page
link

Bulletin Board
bulletins

Private Mail
mail

Online Chat
chat

Choose an option.

This page has been accessed
00228
times.

Figure 14. Sample WebCT interface.

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 Web sites 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.

Section IX
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 (see Figure 15).
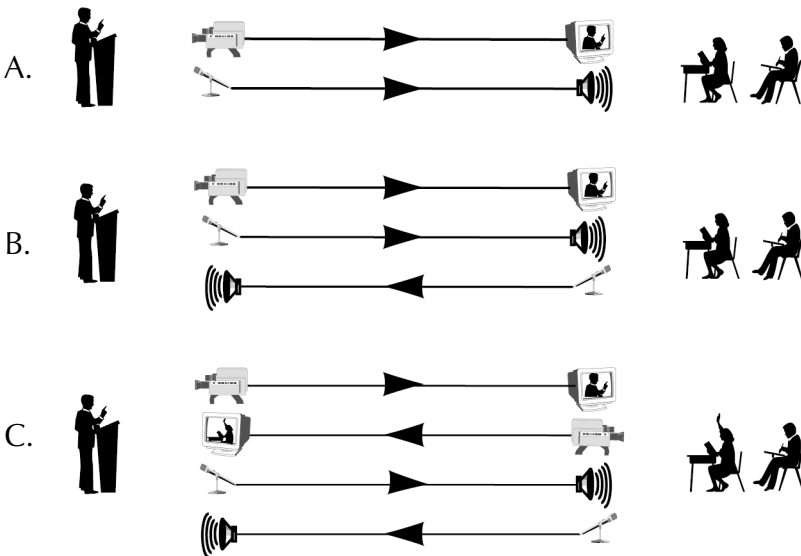
Figure 15.
A. One-way video and one-way audio;
B. One-way video and two-way audio;
C. Two-way video and two-way audio.

Videotapes

Videotapes offer a popular, easy-to-use format for instructional materials. Almost all students have access to a videotape player in their homes, and VCRs are also common at school. Videotapes can be used for demonstrations or documentaries. In addition, it is quite easy to videotape a lecture for a student who is unable to attend class.

Videotapes have several advantages for the delivery of distance learning. In addition to easy access to the hardware, the tapes are quite inexpensive. If a video camcorder is available, videotapes are relatively easy to record (although professional staff and equipment can provide a much better product than will an amateur production team). Disadvantages of videotapes include the fact that they are not interactive. In addition, they wear out with continual use and can be costly to send via the mail.

When using videotapes for instruction, be sure to record them using the best equipment available. If possible, employ professional videographers and editors to achieve professional quality. Interactions through voicemail, e-mail, fax, or other means should also be encouraged.

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 (see Figure 16).
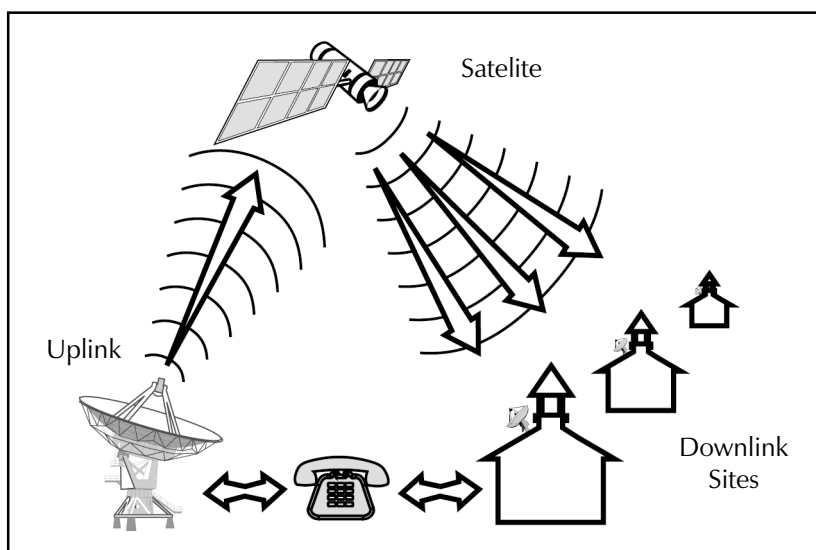
Figure 16. Configuration for satellite videoconferences.

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.

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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 is very expensive. It would 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. One example of an educational system that makes use of satellite communication is EMG (Educational Management Group).

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 (see Figure 17).
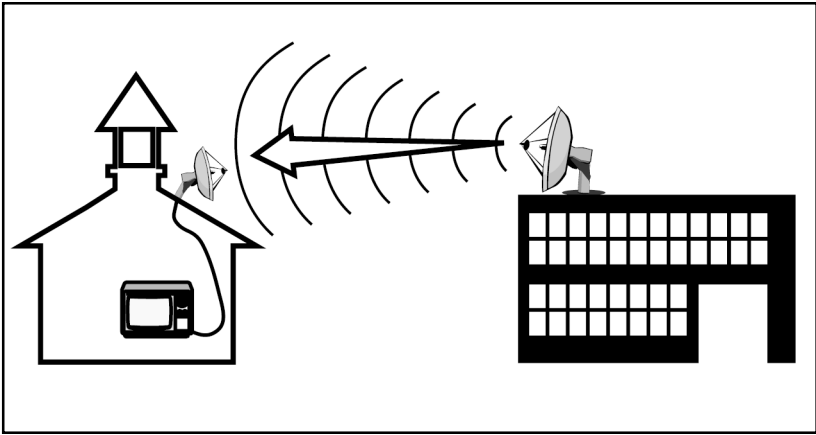
Figure 17. Configuration for microwave transmission.

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, such as CNN and the Learning Channel, 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.

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 tape the program and play it back at a convenient time.

Cable companies will soon be able to use the technology of digital video to offer hundreds of channels to each home and school. Although many of these channels will be used for commercial entertainment purposes, it is almost certain that a large number of channels will become available for education.

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.

With digital videoconferencing, all of the computers involved must have a videoconferencing board installed. These boards often have the ability to compress and decompress the digitized video, and they are called codec boards (see Figure 18). PictureTel and Vtel are two well-known hardware/software companies that supply desktop video solutions for schools.

Digital Lines
(ISDN, LAN, etc.)

Codec (COmpression/DECompression) board
installed in each computer
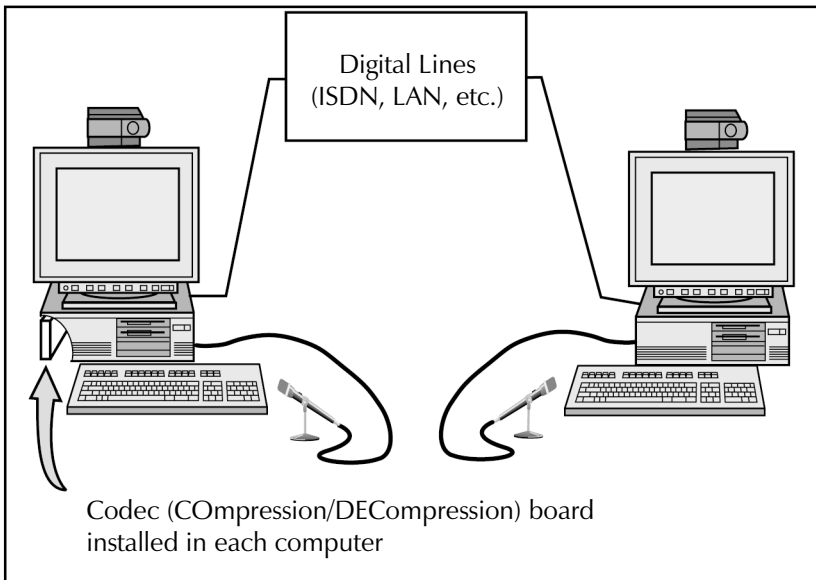
Figure 18. Configuration for desktop videoconferencing.

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 have been demonstrated either through local area networks (LANs) or through relatively fast connections, such as ISDN or T1 lines. Slower connections, such as a connection with a 28.8 modem, can negatively affect the quality of both audio and video.

Internet Videoconferencing

It is also possible to conduct videoconferences over the Internet. Two popular software programs that allow videoconferences are CU-SeeMe from White Pine and NetMeeting from Microsoft.
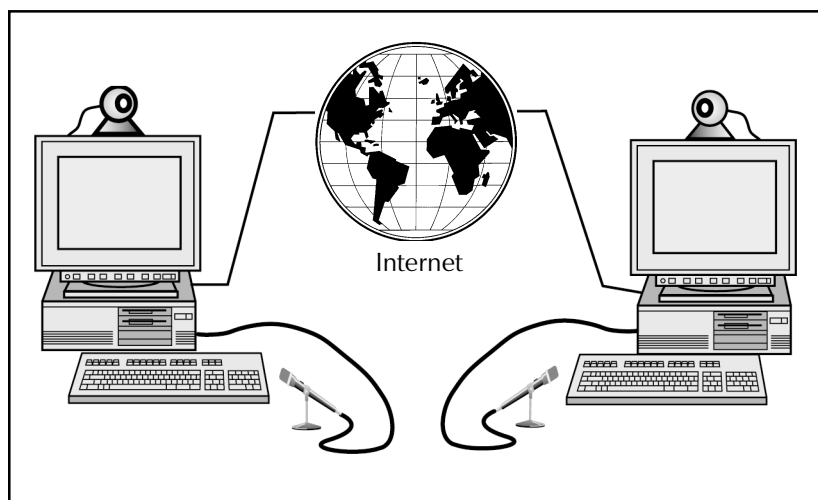
Figure 19. Configuration for Internet videoconferencing.

In both cases, you need a video camera and digitizing card to transmit video signals. A microphone, speakers (or headset) and an audio card are required for audio (see Figure 19).

Internet videoconferencing usually results in a small image about 1/16th the size of a computer screen. The video is generally jerky (about 3 or 4 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.

Figure 20. Typical NetMeeting video image.

While all of this sounds very exciting, it is still very early in the development process. The images that are produced by products like CU-SeeMe are not of sufficient quality for many instructional purposes (see Figure 20). With luck, it is possible to identify an individual if he or she fills the entire window, but even then, there may be poor synchronization between lips and sound.

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. For example, in Florida the rate is $400 per hour for satellite time.

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, 10). 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.

Summary of Distance Learning Technologies

The chart in Figure 21 summarizes the advantages and disadvantages of the major distance learning technologies.

ADVANTAGES:	DISADVANTAGES:
Print Materials	
Inexpensive, Portable High comfort level Readily available	No interactions Requires reading skills Time delay
Voicemail	
Low cost Easy to use Increases interactions	Length may be limited No visual cues May involve toll charges
Audiotape	
Inexpensive Easily accessible Easily duplicated	No visual cues No interaction
Audioconference	
Inexpensive Easy to set up	No visual cues Requires hardware

	ADVANTAGES:	DISADVANTAGES:
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		
	Multimedia capable Worldwide access	Requires computer Requires Web access
Videotape		
	Inexpensive to duplicate Easily accessible Audio and visual elements	Complex to record No interaction Requires hardware
Satellite Videoconferences		
	High realism May be interactive	Expensive hardware Must be scheduled Usually one-way only
Microwave Videoconferences		
	High realism May be interactive Relatively inexpensive	Must be scheduled Limited coverage Line-of-sight transmission
Cable/Broadcast Television		
	Easy to use Easily accessible May be videotaped Includes audio and video	High production costs Requires hardware No interaction Must be scheduled

Figure 21. Advantages and disadvantages of distance learning
technologies.

Implementing Distance Learning

The implementation of distance learning technologies requires careful planning. Figure 22 illustrates the major phases in the implementation process.

1. Conduct needs assessment.

2. Outline instructional goals; produce instructional materials.

Conduct on-going evaluation.

3. Provide training and practice for instructors and facilitators.

4. Implement the program.
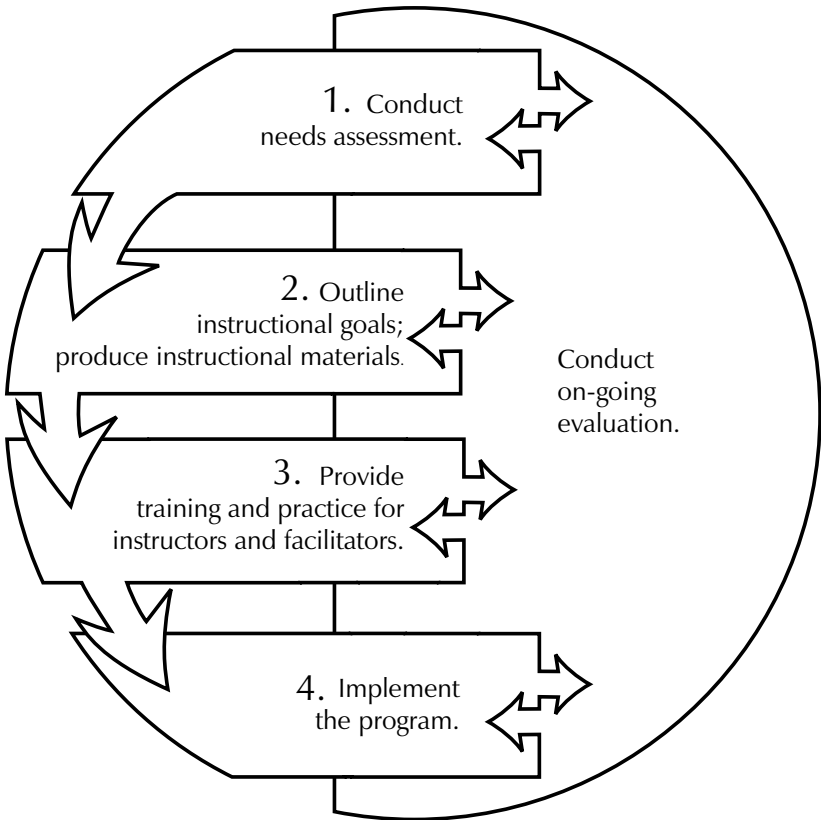
Figure 22. Implementation procedure.

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 attributes and locations of the students. 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. 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 also impact the technology solution. Figure 23 provides recommendations based on the number of sites.

Origination Site(s)	Reception Site(s)	Synchronous	Asynchronous	Technology
One	Many	S		Satellite videoconference
One	Many		A	Video/audiotapes, CD-ROM
Few	Few	S		Computer videoconference
Few	Few		A	Web-based education
Many	Many	S		Internet chat
Many	Many		A	E-mail

Figure 23. Technology analysis.

2. Outline Instructional Goals and Objectives; Produce Instructional Materials

"The danger in not having clear goals and pedagogical objectives is that technology will be acquired but not truly integrated into the teaching, learning, and research of the school" (Horgan, 1998, 2). 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.

"Tele-learning allows us to do the same things, but differently…but also, to do things differently" (Thornburg, 1995). 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, 10). Students of all ages respond positively when they know someone cares.

Conduct On-going 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.

Summative evaluations take place after the instruction is completed and provide 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.

The following factors have been shown to impact the success of a distance learning project:

Keys to Success

- Select the appropriate technology
- Allow plenty of time for planning
- Provide consistent and timely feedback to students
- Encourage student-to-student interactions
- Provide training for the instructors and facilitators
- Ensure a support structure for students
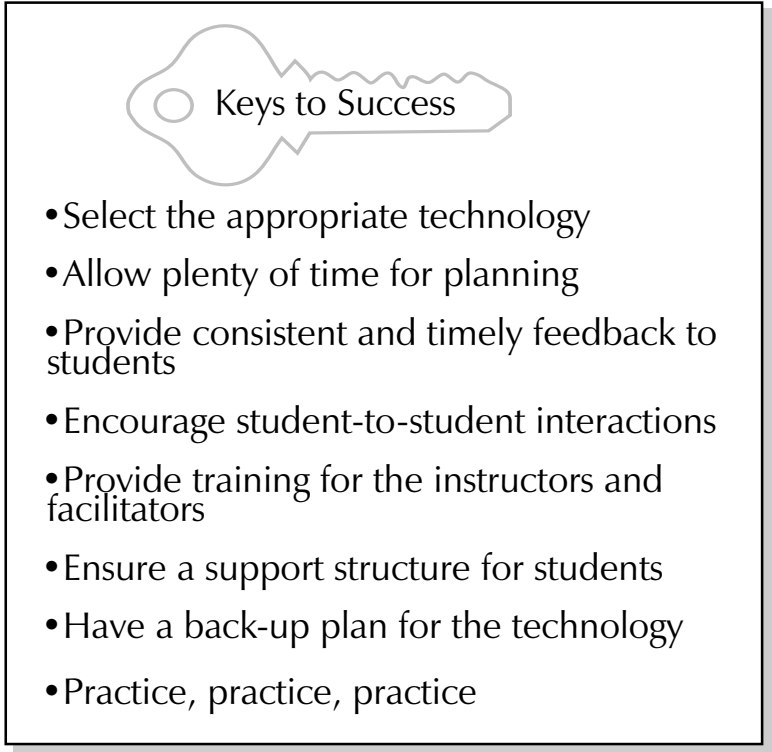- Have a back-up plan for the technology
- Practice, practice, practice

Figure 24. Keys to success.

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Glossary

56 Kbps data line. A special telephone line that is designed to transmit computer data at 56 Kbps. It will probably be replaced by ISDN lines over the next few years.

Acceptable use policy (AUP). A policy that restricts the use to which a computer network may be put. For example, some networks do not allow commercial use.

Analog. Information stored as an electrical signal with a continuous scale. Videotape and audiotape are analog.

Asynchronous. Communications between the student and teacher that do not take place simultaneously.

Audio bridge. A method used to connect multiple telephone lines for an audioconference.

Audioconferencing. Voice-only communications linking two or more sites. In most cases, standard telephone lines and speakerphones are employed.

Audiographic conferencing. Voice communications supplemented with the transmission of still images. Pictures, graphs, or sketches can be transmitted during the conference. Standard facsimile (fax) machines are used, or computer-driven systems can be used.

Bandwidth. The transmission capacity of a telecommunications system. The greater the bandwidth, the greater the amount of digital information that can be transmitted per second.

Baud rate. How many bits a modem can send or receive per second. Derived from the name of Emil Baudot, a nineteenth-century inventor.

Bulletin board. A computer-based meeting place (and its accompanying software) that allows people to discuss topics of interest, upload and download files, and make announcements.

Bits-per-second (bps). A measure for bandwidth or speed of modem transmission. Common rates are 2400, 9600, 14,400 and 28,800.

Bookmarks. A list of sites that can be saved by browser software. The hotlist enables user to access favorite sites without retyping the URL.

Bridge. A device, often leased through a telephone company, that links three or more telephone lines together for audio teleconferencing. See call-in bridge and call-out bridge.

Browser. A software program used to look at various Internet resources. Browsers are either text- or graphics-based.

Byte. A set of bits that represents a single character. Usually there are eight bits in a byte.

C-Band. Satellite transmissions used in older homes— requires a large 6-8 foot antenna.

Call-in bridge. A telephone bridge where the conference is established by having all of the distant sites call in to the bridge telephone number. Long-distance charges are billed to the distant locations.

Call-out bridge. A telephone bridge where one location calls all distant sites to connect each site to the teleconference. Any long-distance charges are billed to the one originating location.

Capture. Saving a file to your computer from a remote system. Capturing data, or saving to disk, allows the user to view or print online data at a later time.

CD-ROM. A small optical disc that can store over 650 MB of digital data.

Chat mode. Synchronous exchange of text through the Internet.

Client. A software program used to contact and obtain data from a server program on another computer; a computer running this software.

Closed circuit television. A point-to-point television distribution system installed on a wire-based system. Used in many schools.

Codec (COmpression-DECompression). An electronic device that converts standard television signals into compressed digital signals for transmission. The same device can convert incoming compressed digital signals back into viewable television signals. A codec allows motion images to be transmitted through special telephone lines.

Commercial online service provider. A company that provides various online services through a service agreement with the user. Examples are America Online, CompuServe, and Prodigy. Most of these services also provide access to the Internet.

Compressed file. A computer file that has been reduced in size through a compression program, such as PKZIP. The user must decompress these files before using.

Compression. Digital signal-processing techniques that are used to reduce the amount of information in a video signal. This allows the video signal to be sent through telephone data lines.

Connect time. The length of time a user is connected to an online service, such as CompuServe or America Online.

Database. A collection of information, usually organized with searchable elements, or fields. For example, a library catalog may be searched by author, title, or subject.

Dedicated telephone line. A permanent telephone connection between computers. Usually a regular phone line that is not used for anything but data transmission.

Desktop videoconference. Multimedia microcomputers are used to display live video images that are transmitted over LANs or digital data lines.

Dial-up connection. A temporary, as opposed to dedicated, connection between machines established over a standard phone line.

Digital. Information that is stored in bits and bytes. Computer data is digital.

Digital data line. A telephone line that is designed to transmit computer data rather than human voices. See 56 Kbps data line, ISDN, T1 line, and T3 line.

Downlink. A location that receives a video teleconference from a satellite.

Download. To transfer a file from a remote computer to your own.

Duplex. A process that allows information to flow in both directions at once, like a standard telephone conversation. Contrasts with simplex.

E-mail. Electronic mail; messages that are sent via a computer network, i.e., electronically. The messages are stored until the addressee accesses the system and retrieves the message.

Fax (facsimile machine). An electronic device that transmits text or graphics material over telephone lines to other locations.

FAQ (Frequently Asked Questions). Files maintained at many Internet sites, especially newsgroups, that provide answers to common problems. Intended to bring novices up to speed without posting repetitive questions.

Fiber optic. Network cable made from glass. Transmits data at extremely fast rates.

FTP (File Transfer Protocol). An application used to transfer files between your computer and another on the Internet. FTP is a special way to login to another Internet site to retrieve and/or send files. Many Internet sites have established publicly accessible material that can be obtained through FTP; the user logs in using the account name anonymous. These sites are called anonymous FTP servers.

GIF (Graphic Interchange Format). A widely used format for image files.

Gopher. A widely used menu system to make materials available over the Internet.

Graphical User Interface (GUI) browsers. Mouse/icon-oriented software used to search the Web. GUI browsers automatically display the graphics embedded in Web pages and usually can be configured to access multimedia features, such as sound. Mosaic and Netscape are two very popular GUI browsers.

Graphics tablet. A computer device that converts hand-drawn images into digital information that can be displayed on computer screens.

Home page. The introductory page to a Web site.

HTML (HyperText Markup Language). Coding language used to create hypertext documents to be posted on the Web. HTML code consists of embedded tags that specify how a block of text should appear, or that specify how the word is linked to another file on the Internet. HTML documents are viewed with a browser, such as Netscape.

HTML editor. A software program that helps to create documents in HTML by automatically embedding the code or tags.

HTTP (HyperText Transport Protocol). The protocol for moving hypertext files across the Internet; the most important protocol used on the Web.

Hypermedia. A program that contains links to other media, such as audio, video, or graphics files.

Hypertext. Any text that contains links to other documents or files.

Internet. An Internet is a network. The term Internet is usually used to refer to a collection of networks interconnected with routers. What has been commonly called the Internet (with the capital I) is the largest Internet in the world.

IRC (Internet Relay Chat). A multi-user live chat protocol. Using the one of the major IRC servers linked to each other, anyone can create a "channel." Anything typed in a channel is seen by all others in the channel.

ISDN (Integrated Services Digital Network). A modern telephone system that allows rapid digital transmission of sound, data, and images.

ISP (Internet Service Provider). A company or other group that provides access to the Internet through dial-up, SLIP/PPP, or direct connection.

ITFS (Instructional Television Fixed Service). A set of microwave frequencies that have been designated for use by educational facilities. Allows line-of-sight television transmissions over ranges of about 20 miles.

JPEG (Joint Photographic Experts Group). A common file format for images.

Ku-Band. Satellite transmissions that use a frequency band between 10.95 Ghz and 14.5 BHX. It is the frequency band used by new home systems.

LAN (local-area network). A computer network limited to a building or area of a building.

Leased line. A phone line established for exclusive data connections from one location to another.

Listserv. A common type of automated mailing list distribution system, developed originally on BITNET, but now common on the Internet. Subscribers receive all messages posted to the list.

Microwave. A high-frequency transmission that can be used for television signals or computer data. Microwave transmissions are said to be line of sight, which means that they cannot pass through tall buildings or mountains.

Modem (MOdulator-DEModulator). A device that enables a computer to transmit and receive data from another computer through a phone line by converting the data into sound.

MPEG (Motion Picture Experts Group). A digital video file format.

Newsgroup. Discussion forum on the Internet.

Offline. Literally, not connected. Used to denote time spent preparing information to upload to a remote system, or to read information downloaded from a remote system.

Online. Communications via a modem or network to a host system; the time the user is actually logged into the host.

Packet. A chunk of data sent across a network; in packet-switching the data being transmitted from one computer to another is broken into packets; each packet has the addresses of its origin and where it is going. These chunks mingle in the same lines and are directed and sorted along the way. This system allows more than one person on a line at the same time.

Parameters. Values that must be set in a telecommunications software program, including number of stop bits, start bits, and speed.

PPP (Point-to-Point Protocol). A protocol that provides a method for TCP/IP to run over a standard phone line. PPP is newer, and faster, than SLIP.

Protocol. A description of message formats and the rules computers must follow to exchange those messages.

Router. A computer or software package that handles the traffic between two or more networks.

Server. A computer, or software package, that provides a specific service for client software running on other computers. For example, a Web server provides clients access to the Web.

Shareware. Software made available free for a limited time. After a trial period, the user is asked to pay a fee to the developer.

Simplex. A communication process that allows information to flow in only one direction at a time. Common speakerphones are simplex devices because only one person can speak at a time. Contrasts with duplex.

Synchronous. Communications between the student and teacher that take place simultaneously.

T1 line. A special type of telephone line that transmits digital information at a high rate. These lines are much more expensive than regular telephone lines.

T3 line. A telephone line that is capable of transmitting digital information at rates even higher than those of a T1 line.

TCP/IP (Transmission Control Protocol/Internet Protocol). The language used by computers to transmit data on the Internet.

Telecommunications software. A program that allows a computer to communicate through a modem to another computer. Most telecommunications software can be configured so that dialing and setting of parameters are automatic.

Teleconferencing. Electronic techniques that are used to allow three or more people at two or more locations to communicate.

Telnet. A program that allows login from one Internet site to another.

Terminal emulation. Telecommunications software allows a computer to appear to be an appropriate terminal, or work station, to a host.

Uplink. The site for a video conference from which a signal is sent to a satellite.

Upload. The process of sending a file from one computer to another.

URL (Uniform Resource Locator). Addressing scheme used to identify Web sites.

Videoconferencing. Transmitting motion video and audio to two or more locations for the purpose of interactive conferencing.

Web (World Wide Web). The network of hypertext servers which allows text, graphics, and sound files to be mixed together and accessed through hyperlinks.

Whiteboard. A graphic display that can be shared by two or more users on a network.

FCIT Resources

Related resources from the Florida Center for Instructional Technology include:

The Internet: Ideas, Activities, and Resources. This booklet provides an overview of the Internet and includes curriculum integration ideas for Florida educators. Also available on the Web at:
http://fcit.coedu.usf.edu/internet/

Getting Started with Telecomunications. This booklet provides information on obtaining and using a Florida Information Resource Network (FIRN) account. Also available on the Web at:
http://fcit.coedu.usf.edu/telecom/

An Educator's Guide to School Networks. This booklet provides an overview of computer networks and their integration into the school setting. Also available on the Web at:
http://fcit.coedu.usf.edu/network/

Language of the Internet. This brochure is a convenient guide to Internet terms and acronyms. Also available on the Web at:
http://fcit.coedu.usf.edu/language/

Searching the Web. This brochure is a beginner's guide to using Web search tools. Also available on the Web at:
http://fcit.coedu.usf.edu/search/

FCAT 4th Grade Reading: A Staff Development Tool is a program designed to help teachers prepare students for the Florida Comprehensive Assessment Test. Also available on the Web at:
http://fcit.coedu.usf.edu/fcat/

A Teacher's Guide to the Holocaust is an overview of the people and events of the Holocaust through photographs, documents, art, music, and literature. Also available on the Web at:
http://fcit.coedu.usf.edu/Holocaust/

Other materials are available from FCIT on the World Wide Web at:

http://fcit.coedu.usf.edu/

To obtain copies of any of the print materials, call the Florida Center for Instructional Technology at 813-974-6953, or e-mail the Center at:

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