USDLA.
UNITED STATES DISTANCE LEARNING ASSOCIATION

AN INSTRUCTIONAL MEDIA SELECTION GUIDE FOR DISTANCE LEARNING

Jolly T. Holden, Ed.D.

Philip J.-L. Westfall, Ph.D.

Chairmen Emeriti
United States Distance Learning Association

Forward

It's not often within the Distance Learning industry that one manages to find a quality overview about Distance Learning technologies, distribution systems and content related support requirements all within one manuscript. Dr. Jolly Holden and Dr. Philip Westfall's new monograph entitled "Instructional Media Selection Guide for Distance Learning" is that rare find.

In a pragmatic and well-written description of appropriate challenges and choices for Distance Learning sources, the authors have created a quality paper based on sound Distance Learning pedagogical theories proven over time and ever ready for the future. This new USDLA publication is a must read for anyone interested in the field of Distance Learning as well as for any veteran of the industry.

John G. Flores, PhD.
Chief Executive Officer
United States Distance Learning Association

Table of Contents

I. Purpose and Use of the Media Selection Guide

Increasingly, educators and trainers are challenged within their respective organizations to provide for the efficient distribution of instructional content using instructional media. The appropriate selection of instructional media to support distance learning is not intuitive and does not occur as a matter of personal preference. On the contrary, instructional media selection is a systematic sequence of qualitative processes based on sound instructional design principles. Although media selection is often mentioned when studying the discipline of instructional technology or Instructional Systems Design (ISD), it is sometimes overlooked when applying the selection process in a distance-learning environment. It is our intent, therefore, for this guide to highlight the essentials of good media selection. We hope to present an instructionally sound and systematic approach to selecting the most appropriate media for the delivery of content at a distance.

Media selection is an integral part of the Instructional Systems Design process. In that role, media selection ensures that a specific distributed instructional medium can support the attainment of the desired learning objectives. To that end, this guide is comprised of five major sections that will assist you in the media selection process to ensure the most appropriate media are selected based on the learning environment:

> **Section II** is an introduction to distance learning which includes definitions, general constructs, a brief historical timeline tracing the evolution of distance learning in the United States, and the family tree [genealogy] of distance learning;

> **Section III** is an introduction to instructional media options for distance learning which includes a description of the various technologies supporting distance learning, a brief overview of synchronous and asynchronous learning environments, a discussion on symmetry of instructional media, and a taxonomy that will assist you in selecting the most appropriate medium or set of media for distance learning.

Section IV is a comprehensive description of the instructional media including the strengths and weaknesses of specific media and the applicable instructional strategies;

Section V consists of a table of instructional strategies that are best suited for distance learning supporting both a synchronous or asynchronous learning environment;

Section VI is introduction to blended learning and discusses the synchronicity and elasticity of learning environments with accompanying depictions;

Section VII contains an introduction to instructional media selection supported by a media selection matrix.

II. An Introduction to Distance Learning

Distance Learning has existed in the United States for more than 120 years. Not surprisingly though, many in the profession considered it a new phenomenon due largely to the emergence of the Internet. The resulting explosion in online learning was quickly embraced throughout the education and training communities encompassing K-12, higher education, and the corporate and government sectors.

Just as new technologies have given rise to new distance learning applications and new distance learning environments, so have they given rise to new terms that basically refer to the same thing. Some of the more popular terms are *e-learning*, *online learning*, and *web-based training*. The mid-1990s saw the coining of the term *advanced distributed learning*, which was quickly adopted by many organizations. Even in the higher education community, where *distance education* was born, there have been revisions to the definition, to include the science of *distance teaching* and the resultant product, *distance learning*.

The definition of distance education in the academic community, however, has gained general consensus through its presence in leading course texts and peer-reviewed journals on the subject. As defined *by The Quarterly Review of Distance Education* journal, distance education is *institutionally based formal education where the learning group is separated and where interactive communications systems are used to connect instructors, learners, and resources.* Alternatively, America's largest professional distance learning organization, the United States Distance Learning Association, has adopted the term distance learning, and defines it as *the acquisition of knowledge and skills through mediated information and instruction.* After the birth of the USDLA in 1989, the Los Alamos National Laboratory organized and sponsored the First Annual Conference on Distance Learning. This conference brought together the leading distance learning professionals from throughout the United States. In attendance were representatives from higher education, K-12, state and local governments, and the federal government. One of the major objectives of the conference was to agree on a universally accepted definition of distance learning. The defini-

tion that emerged was elegant in its simplicity: distance learning was defined as *structured learning that takes place without the physical presence of the instructor.*

In the years that followed the Los Alamos conference, the distance learning landscape was changed dramatically with the development of the browser and the subsequent application of the Internet to online learning. What emerged from this evolution of distance learning was a new set of terms born out of the online learning environment: *Web-based instruction*, *web-based learning*, *web-based training*, *online learning*, and the most prominently new term, *e-learning*.

Unlike *distance learning* or *distance education*, however, the term *e-learning* includes the use of instructional media technologies in its definition, hence the "*e"* for *electronic*. Not surprisingly, the term *e-learning* evolved not from an application, but from the emergence of the business terms "e-commerce" and "e-mail."

Even though the term e-learning was defined by the *American Society for Training & Development* (ASTD) as the *delivery of content via the Internet, intranet-extranet, audio and videotape, satellite broadcast, interactive TV, and CD-ROM*, the marketplace has generally accepted it as applying only to the Internet. As a result, even this term has taken on different meanings, depending upon the organization defining it, and has been variously defined as:

- The educational content, learning services, and delivery solutions that support and enable network-based learning that is either asynchronous or synchronous. *IDC.*
- Internet-enabled learning. *Society for Applied Learning Technology (SALT).*
- Instructional content or learning experiences delivered or enabled by electronic technology. *A Vision for e-Learning: Report of the Commission on Technology & Adult Learning, 2001*

Given the numerous definitions of what appears to be essentially same construct, what are the necessary and sufficient elements of *distance*

learning? On a practical level, for an activity to be considered to be *distance learning* it should include—at minimum—the following:

- ✓ Physical distance between the student and the teacher – the most obvious element
- ✓ An organization that provides the content –in contrast to purely self-directed learning
- ✓ Part of a curriculum –learning must have an objective and therefore must have structure
- ✓ Measurement of learning –without which no learning can be observed to have taken place

We should note that our having left out *interaction* in our definition above is intentional. Whereas interaction is usually desirable for *good* distance learning, we are only considering the *categorical*—not the *evaluative*—sense of distance learning.

Generally speaking then, *distance learning* refers to all forms of learning at a distance, encompassing the full spectrum of instructional media—including non-electronic media—whereas *e-learning* generally refers to those learning activities that employ "electronic" technologies, and *distance education* refers specifically to learning activities within a K-12, higher education, or professional continuing education environment where interaction is an integral component.

Where and When It Really Started

I do not know any innovation upon existing methods more radical and revolutionary than this.

Although this quote sounds as if it were referring to a new technological breakthrough, in reality, this profound statement was uttered by the Reverend Joseph H. Odell, D.D. in his address entitled *The New Era in Education: A Study of the Psychology of Correspondence Methods of Instruction* delivered in November of 1910 at the dedication of the instruction building of the International Correspondence Schools in Scranton, Pennsylvania.

One can follow the evolution of distance learning in the United States from late 19th century, where it was rooted in correspondence, to the adaptation of communication media (radio and TV) in the mid 20th Century, the application of computer-mediated instruction, and the emergence of the Internet in the latter part of the century. While Figure 1 presents a timeline of distance learning, Figure 2 traces the genealogy of distance learning by depicting its early origins to the application of communication media (technology enabled) to computer mediated and electronically assisted learning throughout the past 120 years.

Figure 1

The Historical Timeline of Distance Learning

Figure 2

The Family Tree of Distance Learning
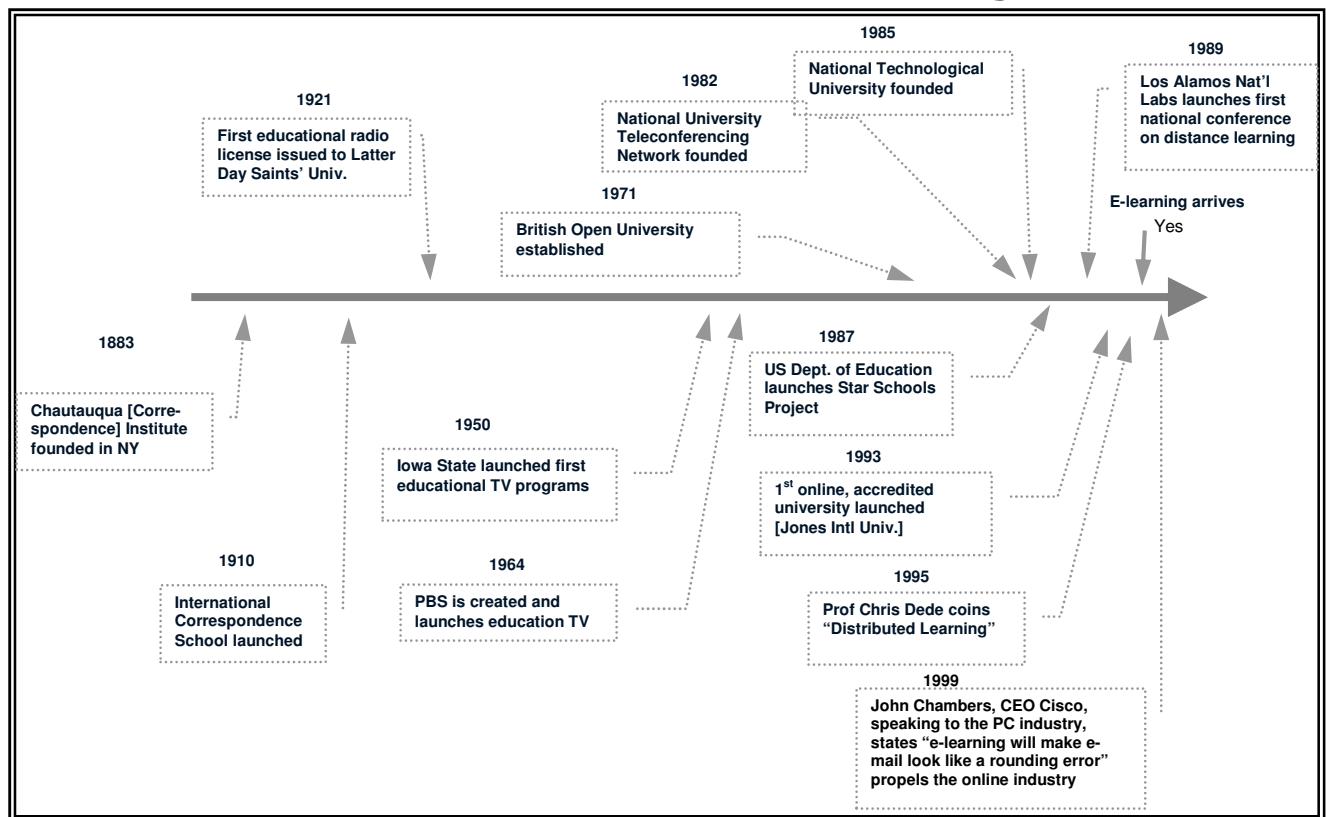
III. Instructional Media for Distance Learning

The selection of appropriate instructional media is an essential element of the instructional design process. Utilizing a systematic approach to media selection ensures that appropriate instructional media are employed to support desired learning objectives. Consequently, the process of media selection is one of identifying the most appropriate medium or set of media for a specific instructional endeavor. Media selection analysis must evaluate general and specific criteria, including instructional, student, and cost aspects for each delivery technology (or instructional medium) in order to ensure that the most appropriate media are selected for specific education or training objective.

Synchronous versus Asynchronous Learning Environments

A synchronous learning environment supports live, two-way oral and/or visual communications between the instructor and the student. This exchange of information facilitates the transfer of knowledge from instructor to the student and can be achieved by 1) the use of audio response systems that support oral communications only; 2) the use of interactive keypad devices that support both the exchange of data and voice; or 3) the use of videoconferencing technologies. Synchronous learning also incorporates these elements:

- Provides for dialectic learning environment with a high level of interactivity
- Encourages spontaneity of responses
- Allows for optimal pacing for best learning retention
- Allows for immediate reinforcement of ideas
- Controls length of instruction when completion time is a constraint
- Is constrained by time but not place

An asynchronous learning environment is when communication between the instructor and the student is not real-time. A typical example of asynchronous instruction in a distance learning environment is the use of text materials (print or electronic) and discussion boards where students re-

spond to questions from the instructor or other students. Asynchronous learning also incorporates these elements:

- Provides for more opportunity for reflective thought
- Not constrained by time or place
- Delays reinforcement of ideas
- Provides for flexibility in delivery of content
- May have higher attrition rate and may extend time for completion

Enabling Technologies Supporting Synchronous & Asynchronous Learning Environments

For the purpose of this guide, the uses of discussion boards and chat rooms are not considered as instructional media delivery options, but instead are viewed as only enabling technologies used to support other instructional media in a blended learning solution.

Symmetrical versus Asymmetrical Learning Environments

In distance learning, considering symmetry of the learning environment is almost as important as considering its synchrony. If not taken into account, it may lead the course designer to make less than optimal choices in media.

Asymmetrical learning or interaction is when the flow if information is predominantly in a single direction such as in a lecture, textbook, or computer based instruction. Conversely, in a conferencing, collaboration, or brainstorming environment, the information flow is symmetrical; that is to say, the information flow is evenly distributed between learners and instructors. A close relationship exists between symmetry and interactivity. The more the interaction, the greater the need for a symmetrical delivery system, whether synchronous or asynchronous

Taxonomy of Distance Learning Media

The Taxonomy of Distance Learning Instructional Media Table (Table 1) is designed to assist in determining the most appropriate media for a specific distance learning application. The taxonomy is focused primarily on a dichotomous learning environment—the initial selection criteria being either

synchronous or asynchronous, and will aid the instructional designer or subject matter expert (SME) in determining the most appropriate media to be selected.

The instructional designer may choose a combination of media to meet the desired learning objectives. For example, delivery of content can be accomplished using one asymmetrical medium (e.g., satellite or print) but the interactive aspect can be accomplished using a symmetrical medium (e.g., audio conferencing or e-mail). Why is it important for the designer to consider symmetry? Using symmetrical delivery systems (normally involving lower bandwidth or shared bandwidth) for asymmetrical applications either reduces capacity for transmission outbound from the instructor or wastes capacity inbound from the student—inefficiency that under certain circumstances could be costly. The same is true for using an asymmetrical technology for a symmetrical application—the costly inefficiencies under these circumstances would be apparent (Figure 3).

Table 1
Taxonomy of Distance Learning Instructional Media

	Synchronous	**Asynchronous**
Visual Only (includes graphics)		✓ Correspondence (print) ✓ Recorded Video
Aural Only	✓ Audio Conferencing	✓ Recorded Audio
Visual & Aural	✓ Instructional Television Satellite e-Learning ✓ Video Teleconferencing ✓ Synchronous Web-based Instruction ✓ Audiographics	✓ Recorded Video ✓ Computer Based Instruction ✓ Asynchronous Web Based Instruction (WBI) ✓ Instructional Television

Figure 3

Symmetry of Interactivity & Instructional Media

High	
Symmetry ↑	• Video Conferencing • Audio Conferencing • Internet-based
• Print • Tape/DVD/CDROM • Satellite • ITFS	

Low → **High**

Interactivity
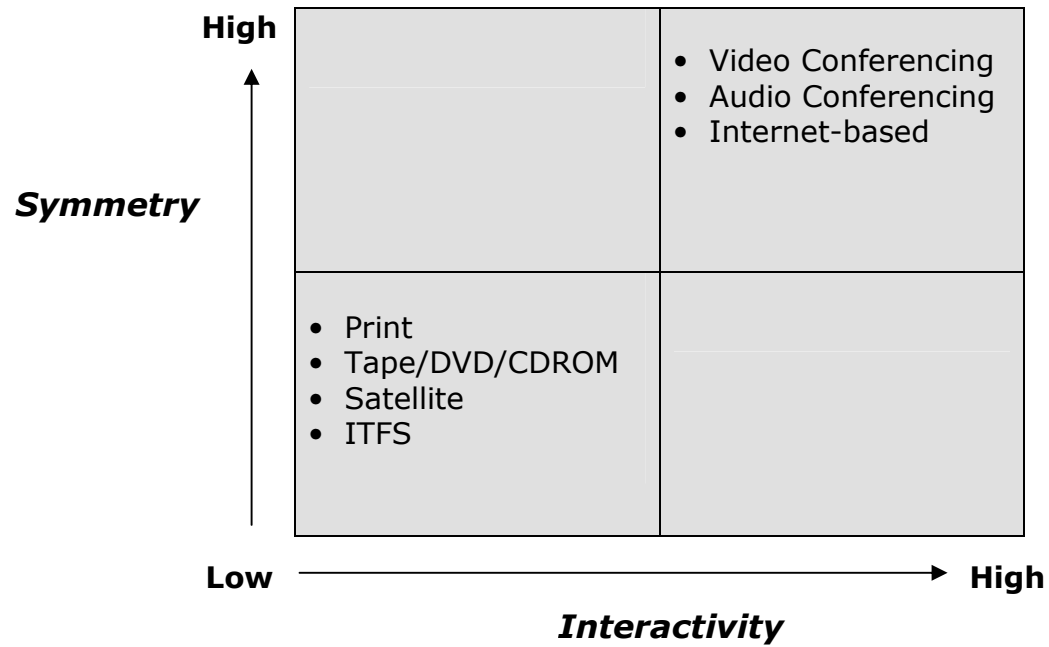
IV. Instructional Media Delivery for Distance Learning

An analysis of available technologies must include a thorough examination of the advantages and limitations that each present within the learning environment. Considerations must be given to instructional objectives, development and deployment of instructional strategies, level and type of interaction between the instructor and the student, display of visual images, video and audio, responsiveness to changes in course content, efficiency of the delivery system, and total system cost.

Table 2 provides an explanation of the available media that can support the distribution of content for distance learning.

Table 2

Instructional Media Delivery Options for Distance Learning

Technology Delivery	Description
Asynchronous Web-Based Instruction (WBI)	On-demand, online-based instruction stored on a server and accessed across a distributed electronic network. It can be delivered over the Internet or private local area network (LANs) or Wide Area Networks (WANs) where the content is displayed utilizing a web browser. Student access is asynchronous, self-paced, and does not provide for synchronous interaction between the instructor and the remote student. High-resolution images and video may be limited due to available bandwidth.
Audio Conferencing	An audio-only environment in which students in different locations use telephones or audio conferencing equipment to communicate with each other in real time. Supports a synchronous interactive environment between the instructor, remote students, and multiple sites but does not support visual images and graphics, and often supplemented by electronic or printed handouts. Can be integrated with other delivery systems to provide synchronous audio.

Audiographics	Audiographics combines audio conferencing with personal computer text and graphics, allowing both voice and data to be transmitted to remote sites. Typically, a site consists of audio conference equipment, plus a large screen that serves as an electronic whiteboard. This system allows for two-way data exchange (limited to high-resolution still images only) and a synchronous interactive environment between the instructor and students at multiple sites.
Computer Based Instruction (CBI)	Interactive instructional experience between a computer and the learner where the computer provides the majority of the stimulus and the student responds. The computer is the storage and delivery device with all content resident on the student's computer. It provides the primary display and storage capability and can support high-resolution images and video.
Correspondence (print)	Entirely print-based, asynchronous and self-paced. Can be augmented through the use of multimedia CD-ROM. Instructor feedback can be facilitated through the use of e-mail. Used extensively to support other media
Instructional Television (ITV)	ITV is defined as a one-way, full motion video and audio transmission of classroom instruction through a telecommunications channel such as satellite, cable TV, or Instructional TV Fixed Service (ITFS), a dedicated 2.5GHz spectrum managed by the FCC and limited to educational programming only, usually transmitted via microwave towers. This medium, when combined with an audio response or keypad system supports the capability for students to spontaneously ask questions of the instructor and respond to other students at multiple remote sites (Note: The synchronous, two-way audio is normally provided by a telephone carrier utilizing an audio bridge and normal terrestrial phone service. This specific application would not be available to instruc-

	tional programming received via commercial cable TV). Due to the bandwidth available via satellite or ITFS, this delivery medium can emulate the live, traditional classroom environment but at a distance. ITV is sometimes referred to as Business Television (BTV), Interactive Video Teletraining, or Interactive TV, and can be transmitted via analog or digital systems.
Recorded Audio (Tape and digital broadcast)	Recorded audio content—on tape or transmitted electronically—which can be used as a stand-alone delivery tool or part of a blended learning approach. Can be used as the sole means of content or as part of a blended approach.
Recorded Video (Tape and digital broadcast)	A method of capturing learning content on tape or as a digital file for viewing on-demand. Can be used as the sole means of content or as part of a blended approach. Often used to capture a real time event and is an effective distribution medium that supports high-resolution images and video but does not support a synchronous interactive environment between the instructor and the remote student.
Satellite e-learning	Satellite e-learning represents the next generation of distributed media. Utilizing IP (Internet Protocol) as the network layer and distribution technology, it also incorporates the latest MPEG (Moving Picture Experts Group) video standard or latest version of Widows Media. Similar in application to ITV, it allows for the live traditional classroom to be transmitted to a remote site while synchronous oral interactivity is supported by audio teleconferencing or student response systems integrating audio and keypad technology (data interaction). Additionally, since satellite e-learning uses IP, video streaming can be utilized at extremely high bandwidths (~3.0Mbps). The IP-based video can be distributed directly to the user's end-point and then distributed via the LAN to either

	a classroom or desktop computer, or both. Also, satellite e-learning can easily transmit large multi-media/web-based training modules (known as data casting) without being constrained by bandwidth, as is common with a terrestrial network. This capability allows the data to bypass the WAN by transmitting directly to the user's end-point and then distributed locally via the LAN, thereby effectively bypassing the terrestrial infrastructure and the Internet. Satellite e-learning is also referred to as BTV/IP (Business Tele-vision/Internet Protocol).
Synchronous Web-Based Instruction (WBI)	Internet-based software and services delivered over the Web that enable synchronous audio or web con-ferencing, text chat, audio, video, document and ap-plication sharing, whiteboards, presentations, etc. Can support synchronous oral interaction between the instructor and remote students at multiple loca-tions as well as supporting a Multi-User Virtual Envi-ronment (MUVE) or webinars. Due to bandwidth limitations, high-resolution images and video may be limited.
Video Teleconferenc-ing (VTC)	VTC systems are two-way communication systems that offer both audio and video from local and re-mote sites and provide for synchronous interaction between the instructor and remote students at mul-tiple locations. It allows for the instructor to observe the students at the far end (remote location), allow-ing the student to demonstrate an event. These sys-tems can be terrestrial, satellite-based, or micro-wave-based Instructional TV Fixed Service (ITFS). Generally VTCs transmit and receive between 384Kbps – 1.5Mbps, with the next generation cod-ers/decoders (codecs) IP enabled.

Strengths and Weaknesses of Instructional Delivery Media

The aforementioned instructional media can support the delivery of instructional content as stand-alone media, or integrated to create a blended learning solution. Also, any combination of the media could be used to compliment the traditional classroom environment for a blended learning solution.

Some instructional media, however, may be *more* appropriate than others depending upon their strengths in supporting either a synchronous or asynchronous learning environment. To that end, no single medium is inherently *better* or *worse* than other medium, just as a truck is not inherently better or worse than a sedan. They are all vehicles that simply deliver their contents. As discussed later in this Guide, the selection of the most appropriate media is *not* based *solely* on the attributes for that specific medium, but other considerations as well.

Asynchronous Web-Based Instruction (WBI)

Strengths: WBI can provide consistent delivery to widely dispersed and large audiences using the Internet or an existing WAN/LAN infrastructure. The student's computer monitor becomes the primary display device, but unlike CBI, the content does not reside on the student's computer but is stored remotely and accessed through distributed technologies.

WBI can incorporate many of the features of CBI such as self-paced instruction, drill and practice, remediation and intervention. Although it is best suited for content that does not require continuous and frequent revision, WBI does allow content to be updated more easily than CBI because the content resides on a remote storage device such as a server.

Additionally, content and testing can be integrated with a Learning Management Systems (LMS) and "modularized" into small units of instruction suitable for assembly and reassembly into a variety of courses. Also, WBI can incorporate synchronous interactive technologies such as live chat rooms and instructor originated audio that can provide for instructor facilitation and feedback. Since WBI is an asynchronous technology, the stu-

dent is not limited to a set time and--to a limited degree--is not restricted to accessing the content from a set place. All a student needs is a computer terminal with Internet access.

Weaknesses: WBI is technology dependent, requiring Internet connectivity and a higher degree of computer literacy than basic computer knowledge. Also, bandwidth limitations can affect the design of the content. For example, dialup Internet access (narrowband) may preclude the use of video and high-resolution graphics, resulting in a predominately text-based learning module. Alternatively, courses designed with high-impact visuals or video that requires broadband access could potentially reduce the number of students who could access the module, thereby increasing costs. And, as with CBI, reading large amounts of text on a computer screen results in a reduction of comprehension and speed when compared to print. Finally, design and development, as well as annual recurring maintenance, could be significant cost factors.

Appropriate Instructional Strategies	
• Narration/Description (Lecture) • Demonstrations • Simulations • Illustrations • Drill and Practice • Tutorials	• Case Studies • Modeling • Role Playing

Audio Conferencing

Strengths: While students may have difficulty remaining engaged in course material delivered entirely via this medium, audio-conferencing can be a valuable support technology if students need to receive modification or updates to course content quickly, or have the need to interact with instructors and fellow students. It is often most effective when accompanied with other media such as printed text or graphic, and can be integrated with ITV or satellite e-learning to provide for two voice communication.

Weaknesses: Limited to oral interaction only, does not support visuals. Consequently, cannot utilize the full spectrum of instructional strategies.

Appropriate Instructional Strategies
• Narration/Description (Lecture) • Discussion • Brainstorming

Audiographics (Electronic White Boards)

Strengths: By combining audio conferencing with text and graphics, audiographics can transmit both voice and data (text) to remote sites. This distributed technology provides for synchronous communication to the remote student, thereby supporting a dialectic learning environment.

Weaknesses: Limited to oral interaction only and, due to potential bandwidth restrictions, limited to still images only. Though resolution and quality of visuals may be limited, it is a very cost effective instructional media

Appropriate Instructional Strategies
• Narration/Description (Lecture) • Discussion • Brainstorming • Illustrations

Computer-Based Instruction (CBI)

Strengths: In CBI, instruction not affected by bandwidth as are other distributed media technologies. It can display large amounts of visual and aural information. CBI's ability to use full-motion video and high resolution graphics, and when supplemented with audio, allows users to employ the full spectrum of instructional strategies. Students can control the pace of instruction and receive immediate feedback to reinforce learning outcomes. Additionally, intervention strategies and remedial instruction can be designed into a CBI course.

Since CBI is an asynchronous medium it can promote drill and practice, which is sometimes a key strategy for increasing retention. Activation and exploratory learning strategies can also be designed into the instruction to further enhance retention. CBI is best suited to content that does not often change or require revisions. Costs of design and production can be spread across wide student populations.

Weaknesses: CBI does not provide for an unstructured, dialectic environment. Students cannot interact with the instructor by asking questions, so facilitation by the instructor is not available. Development costs may be extremely high due to numerous variables: level of interactivity, amount of visual & aural information, design of graphics and other visuals, etc. Significant annual maintenance costs could be incurred if the content changes often. Distribution efforts may require additional resources to track mailing and ensure all students have the latest version. Media content cannot be modified or updated easily and may require an upgrade of hardware (sound card, speakers, memory, graphics card). Research has shown that reading large amounts of text on a computer screen results in a reduction of comprehension and speed when compared to print. Often used as a self-study medium, students may feel isolated and unmotivated to complete training.

Appropriate Instructional Strategies	
• Narration/Description • Case Studies • Role Playing • Demonstration • Illustrations	• Simulation • Drill and Practice • Tutorials

Correspondence (print)

Strengths: Correspondence courses are the epitome of anytime, anyplace learning because they do not rely on any technological infrastructure to deliver or view the material. Correspondence courses are often complimented by multimedia (DVD, CD-ROM, videotape, audiotape) to enhance the printed material. Print has the ability to reach students who are

widely dispersed and do not have Internet access. Print can provide for inexpensive representation of static visuals such as charts, graphics, images, etc. It is the most used medium in distance learning.

Weaknesses: This asynchronous medium can significantly limit the number of instructional strategies that can be employed. It also requires a logistical infrastructure to write, assemble, package, and deliver the printed materials. If the content changes, course update can be cumbersome and slow.

Appropriate Instructional Strategies
• Narration/Description • Drill and Practice • Case Studies • Narration

Instructional Television (ITV)

Strengths: ITV has the ability to emulate the live classroom environment when coupled with audio conferencing or key-pad response system. ITV can be a highly interactive [dialectic] learning environment. Because satellite is not constrained by bandwidth, it does not constrain the instructor in the use of any media used in a traditional classroom environment; it can ensure a consistent delivery of content across geographical boundaries to a much larger audience in a shorter period of time. It can also provide high levels of synchronous oral interaction and immediate feedback to questions despite the distance between instructor and students. Due to the broadcast nature of satellite, the number of sites receiving the broadcast is technically unlimited, and is only constrained by the total class size. Satellite e-learning, therefore, is a very efficient instructional medium. Additionally, with the advancements of Internet Protocol (IP) for satellite, satellite broadcasts have the capability to be delivered throughout a LAN/WAN environment to the students' computer.

Weaknesses: ITV requires the availability of a satellite broadcast infrastructure that includes the satellite receive sites (satellite downlinks) and

some form of studio-classroom used to originate the class to be broadcast. Satellite equipment requires a significant capital outlay and annual recurring costs for satellite transmission and maintenance must be programmed. Because it is predominately a live classroom transmission, learners are confined to a specific time and space requirement. Special training of the instructor is necessary, as is a staff to manage the studio and broadcast equipment.

Appropriate Instructional Strategies	
• Narration/Description (Lecture) • Guided Discussion • Brainstorming • Case Studies	• Role Playing • Panel Discussion • Simulation • Demonstration • Drill and Practice

Recorded Audio (tape, CD ROM, or podcast)

Strengths: Recorded audio provides for a large amount of aural content and can be continually reviewed. Whether by tape or podcast, it is a very inexpensive distribution medium that can reach widely dispersed students.

Weaknesses: Lack of graphics or video limit its use for many instructional strategies.

Appropriate Instructional Strategies
• Narration/Description (Lecture)

Recorded Video (tape, DVD, Vodcasting)

Strengths: Videotape, DVD, and (to a lesser extent) Vodcasting can provide large amounts of full-motion video and high-impact visuals, self-pacing, and continual review of the content.

Weaknesses: Production and distribution costs can be high (especially for tape and DVD), and if content is revised frequently, recurring maintenance costs can also be significant. Additionally, since recorded video does not provide interaction between the instructor and remote students.

Recorded video is often not updated frequently, leading to content becoming outdated depending on the volatility of the subject matter.

Appropriate Instructional Strategies
• Narration/Description (Lecture) • Case Studies • Illustrations

Satellite e-Learning

Strengths: Because satellite e-learning is not constrained by bandwidth, it can transmit large data files (CBI or WBI)--rich in multimedia--to the user's end-point, thereby bypassing the WAN and the Internet. It does not limit the instructor in the use of media that supports a traditional classroom environment, and it can ensure a consistent delivery of content across geographical boundaries to a larger audience in a shorter period of time. It can also provide high levels of synchronous oral interaction and immediate feedback to questions despite the distance between instructor and students. Due to the broadcast nature of satellite, the number of sites receiving the broadcast is technically unlimited, and is only constrained by the total class size.

Weaknesses: Satellite e-learning requires the availability of a satellite broadcast infrastructure that includes the satellite receive sites (satellite downlinks) and some form of studio-classroom used to originate the class to be broadcast. Satellite equipment requires a significant capital outlay, and annual recurring costs for satellite transmission and maintenance must be programmed. Because it is predominately a live classroom transmission, learners are confined to a specific time and space requirement. Special training of the instructor is necessary, as is a staff to manage the studio and broadcast equipment. It also is subject to "last-mile" constraints as the signal must pass through segments of the LAN to reach the desktop

Appropriate Instructional Strategies	
• Narration/Description (Lecture) • Guided Discussion • Brainstorming • Case Studies	• Role Playing • Panel Discussion • Simulation • Demonstration • Drill and Practice

Synchronous Web-Based Instruction (WBI)

Strengths: Synchronous WBI provides the same advantages as asynchronous WBI but, due to its real-time nature, can also accommodate live interaction with the instructor, experts, and other students. In addition to supporting synchronous learning environments, WBI also makes it possible to archive the live content for later viewing. It also allows for flexible access from any computer connected to the Internet.

Weaknesses: As with its asynchronous version, WBI, it requires some level of computer experience and student familiarity with application software. Additionally, bandwidth restrictions can constrain the use of video, images, and graphics. Also, firewall issues may prevent student access from certain locations, and the use of synchronous communications may restrict the number of students accessing the module at any given time. And, as with all types of computer screen displays, reading large amounts of text results in a reduction of comprehension and speed when compared to print.

Appropriate Instructional Strategies	
• Narration/Description (Lecture) • Discussion • Simulation	• Case Studies • Demonstration • Illustrations

Video Teleconferencing (VTC)

Strengths: VTC incorporates many of the advantages of ITV including emulating the live classroom environment. Perhaps its strongest attribute and advantage over other distributed instructional media, however, is that it allows the instructor to view the students at the remote site (far end).

This significant advantage allows for the student to demonstrate an event, task, or procedure, which can then be observed and evaluated by the instructor. Since VTC operates in a synchronous environment, it can be highly interactive by providing immediate feedback, both aural and visual. Since the VTC infrastructure supports instructional origination from any connected site on the network, remote presenters, guests, and subject matter experts (SMEs) have the ability to be integrated into the live session. Optional equipment such as VCRs, video scan converters, document cameras, etc., allow instructors to include video illustrations, display PC application screens, and "zoom in" on objects for classroom discussion. VTC can operate over existing LAN/WAN infrastructures and, with the emergence of video-based IP, can be distributed to and displayed by a computer monitor.

Weaknesses: VTC may present access problems if the necessary equipment is not available locally. Delays due to compression and decompression rates of video may result in video and audio that is out of synchronization, distracting learners. System bridging limits may constrain the number of sites that can participate in a single session. Due to availability and cost of bandwidth, the instructor may be constrained in the use of some media that require high bandwidth applications such as detailed graphics. Additionally, due to the amount of aural and visual sensory input confronted by the instructor originating from the remote sites, there may be some limitation to number of remote sites participating in the class. VTC is typically best for organizations with a small to moderate number of participating locations.

Appropriate Instructional Strategies	
• Narration/Description (Lecture) • Guided Discussion • Brainstorming • Case Studies	• Role Playing • Panel Discussion • Demonstration • Drill and Practice

V. Instructional Strategies Supporting Distance Learning

The dissemination of content through the use of distance learning media is only as effective as the design of the instruction. Regardless of the learning environment, instruction is designed to transfer knowledge from the instructor to the learner to the real-world environment. And transfer of learning is facilitated by the development of instructional strategies. Scholars have identified learning to be primarily a social, dialogical process. Social learning theory suggests that most human learning takes place in a social context where their behavior is modeled by others. This modeling can occur through lecture, guided discussions, role-playing, case studies, and other instructional strategies. Each distance learning medium, as depicted in the *Taxonomy of Distance Learning Instructional Media*, has its strengths and weaknesses when supporting various instructional strategies. No single medium can support all instructional strategies.

How does this reality influence media selection and choice of instructional strategies? Quite simply, certain synchronous instructional technologies such as satellite e-learning, video teleconferencing, and synchronous web-based instruction, are best suited for instructional strategies that require a live and dialectic learning environment. And conversely, there are asynchronous instructional technologies that are best integrated with strategies that require asynchronous learning environment.

So how does this all come together? How do you ensure that the most appropriate distributed instructional media are selected based on specific learning objectives? By combining the *Distance Learning Instructional Media Selection Matrix* with the *Table of Instructional Media Delivery Options for Distance Learning* and the instructional strategies listed below, you can increase the probability of selecting the most appropriate set of media.

The instructional strategies depicted have proven to be effective in facilitating the transfer of learning, and because in any given program of instruction has multiple learning objectives, it follows that finding the right medium-to-objective match will likely result in a *blended media* approach.

Table 3

Instructional Strategies for Distance Learning

Instructional Strategies	Description
Narration/ Description (Lecture)	Allows for transfer of learning through mere declaration and explication of knowledge. When interaction is available, it allows for reinforcement of behavior, spontaneous questioning, dialogue, and social interaction with immediate feedback.
Demonstration	Skill transfer through the depiction of procedural tasks, events, processes, etc.
Role Playing	Involves recreating a situation relating to a real-world problem in which participants act out various roles. Promotes an understanding of other people's positions and their attitudes as well as the procedures that may be used for diagnosing and solving problems. Learners may assume the role of a particular character, organization, professional occupation, etc.
Guided Discussion	Supports a synchronous, dialectic learning environment through the spontaneous and free-flowing exchange of information. Encourages active, participatory learning that supports knowledge transfer through dialogue. Students may discuss material more in-depth, share insights and experiences, and answer questions.
Simulation	Replicates or mimics a real event and allows for continual observation. A simulation creates a realistic model of an actual situation or environment.
Illustration	Depicts abstract concepts with evocative, palpable real-world examples.
Imagery	Imagery is the mental visualization of objects, events, and arrays. It enables internalized visual images that relate to information to be learned. Imagery helps to create or recreate an experience

	in the learner's mind. Imagery involves all the senses: visual, kinesthetic, auditory, and tactile.
Modeling	A contrived, simplified version of an object or concept that encapsulates its salient features.
Brainstorming	Brainstorming is a valid and effective problem-solving method in which criticism is delayed and imaginative ways of understanding a situation are welcomed, where quantity is wanted and combination and improvement are sought. Brainstorming can occur with individuals or in a group setting, and involves generating a vast number of ideas in order to find an effective method for solving a problem.
Case Studies	A problem-solving strategy similar to simulation that works by presenting a realistic situation that requires learners to respond and explore possible solutions.
Drill & Practice	Repetition of a task or behavior until the desired learning outcome is achieved. Allows for transfer of knowledge from working memory to long-term memory.

VI. Integrating Distance Learning Media: A Blended Learning Approach

What is *blended* learning? Simply stated, blended learning is *instruction using multiple media.* Although appearing somewhat all-encompassing, this definition includes the integration of instructional media into a traditional classroom or into a distance learning environment. However, there is some discussion as to where technology insertion in the classroom ends and blended learning begins. Suffice it to say that blended learning can include any combination of media that supports instruction, regardless of the mix of synchronous or asynchronous media.

Figure 4 depicts the integration of synchronous and asynchronous media that can result in a blended learning solution. There are no prescribed solutions to integrating media, and in many instances, there are multiple blended learning approaches. The economy of scale and power of blended learning is derived from its "elasticity": the ability to integrate a variety of synchronous and asynchronous media allowing the instructional designer to attain the most appropriate blended learning solution (Figure 5). Whereas the delivery technology does not alter the content, certain instructional media can affect the design of instruction, and as long as the "most appropriate" media are selected, learning outcomes will not be affected.

When developing a blended learning solution, maintaining instructional quality is paramount. To that end, learning objectives should never be sacrificed to achieve a blended learning solution. Also, when integrating instructional strategies (which are the products of learning objectives and serve to ensure the learning objectives are attained), some strategies may be more appropriate than others to achieve optimal learning.

Figure 4

Blended Learning--An Integration of Media

Synchronous Media   *Asynchronous Media*

Blended Learning Solution
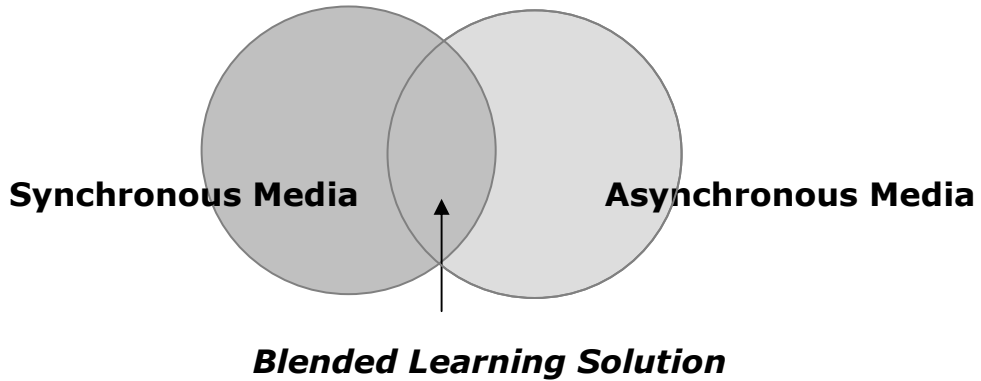
Therefore, when selecting the most appropriate media one must consider the following:

➢ Asynchronous media may be more appropriate for the lower cognitive levels where knowledge & comprehension and repetition or drill & practice are the primary focus

➢ Synchronous media may be more appropriate for the higher cognitive levels (synthesis, analysis, evaluation) where a synchronous learning environment is required to support a high level of interaction (dialogue).

➢ Symmetry: To avoid inefficient (and perhaps costly) use of technology, symmetry of teaching strategy and technology should be matched. The key to efficient use of media is to use a judicious blend of symmetrical and asymmetrical systems. Delivery of extensive amounts of content (high-end graphics, large CBI files, etc.) to a dispersed audience, for example, should be (in most cases) accomplished over asymmetrical systems (Figure 6).

Figure 5

The Elasticity of Blended Learning

Synchronous Media

Asynchronous Media

- Instructional TV
- Satellite e-Learning
- Video Teleconferencing
- Audio Conferencing
- Audio Graphics
- Synchronous WBI

Asynchronous Media

Synchronous Media

- Correspondence
- Asynchronous WBI
- Computer-based Instruction (CBI)
- Pre-recorded video/audio
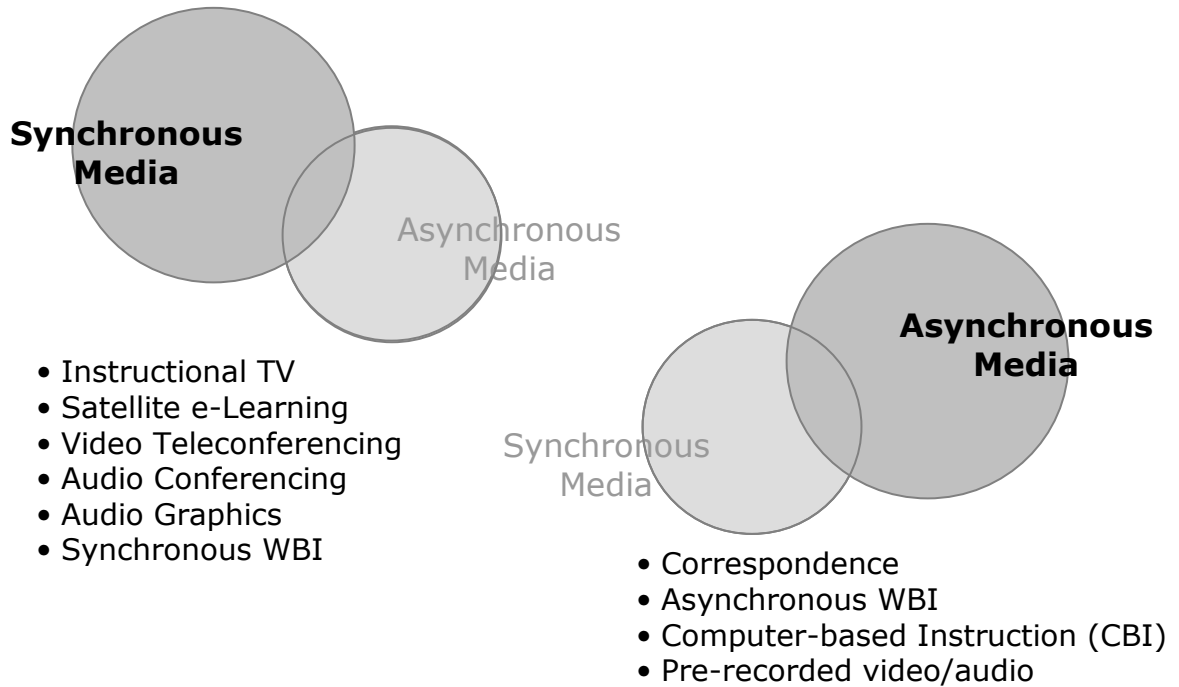
Figure 6

Symmetry of Interactivity & Instructional Strategies

High

Symmetry

- Role Playing
- Guided Discussion
- Q&A
- Brainstorming

- Narration/Lecture
- Demonstration
- Simulation
- Illustration
- Imagery
- Modeling
- Drill & Practice

Low   *Interaction*   High
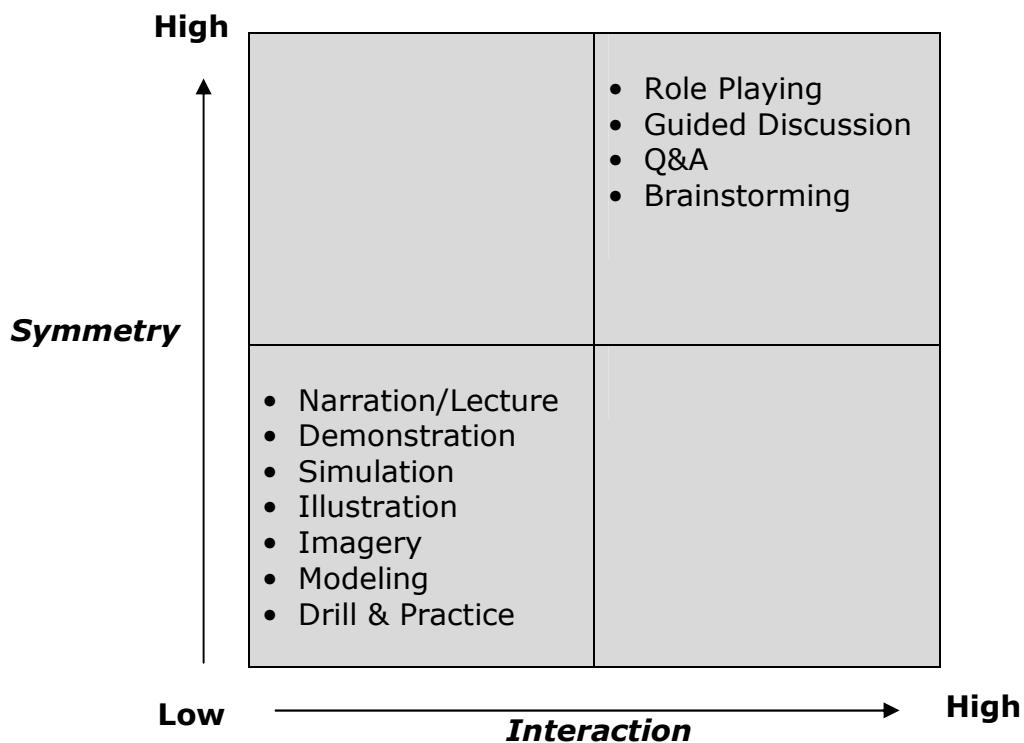
VII. Distance Learning Instructional Media Selection

The instructional media selection process is a systematic approach based upon the instructional systems design (ISD) model. When selecting the most appropriate instructional media for distance learning, consideration must be given to a number of variables that may influence the selection of one medium over another.

Some instructional issues that must be considered are:

➢ Identification of knowledge and skill gaps
➢ Effective assessment and measurement tools
➢ Level of interaction (didactic versus dialectic)
➢ Instructional strategies
➢ Complexity of content
➢ Rate of content change

Delivery issues to consider are:

➢ Audience size & distribution
➢ Cost
  • In house vs. outsourcing
  • Availability of existing infrastructure
  • Delivery - hardware endpoints
    o Video teleconferencing equipment
    o Satellite receivers
    o WAN/LAN system/connectivity
    o TV/monitor, display devices, servers/computers

Conclusion

Throughout this Guide, the focus of instructional media selection has been on the learning environment, and not the technology, as the primary determinate in selecting the most appropriate media. This sentiment has been echoed in other similar journal articles, and most notably by the U.S. Congress, Office of Technology Assessment, in their benchmark report: *Power On! New Tools for Teaching and Learning*, where it was stated:

> *There is no single best model of distance learning. The quality and effectiveness of distance learning are determined by instructional design*
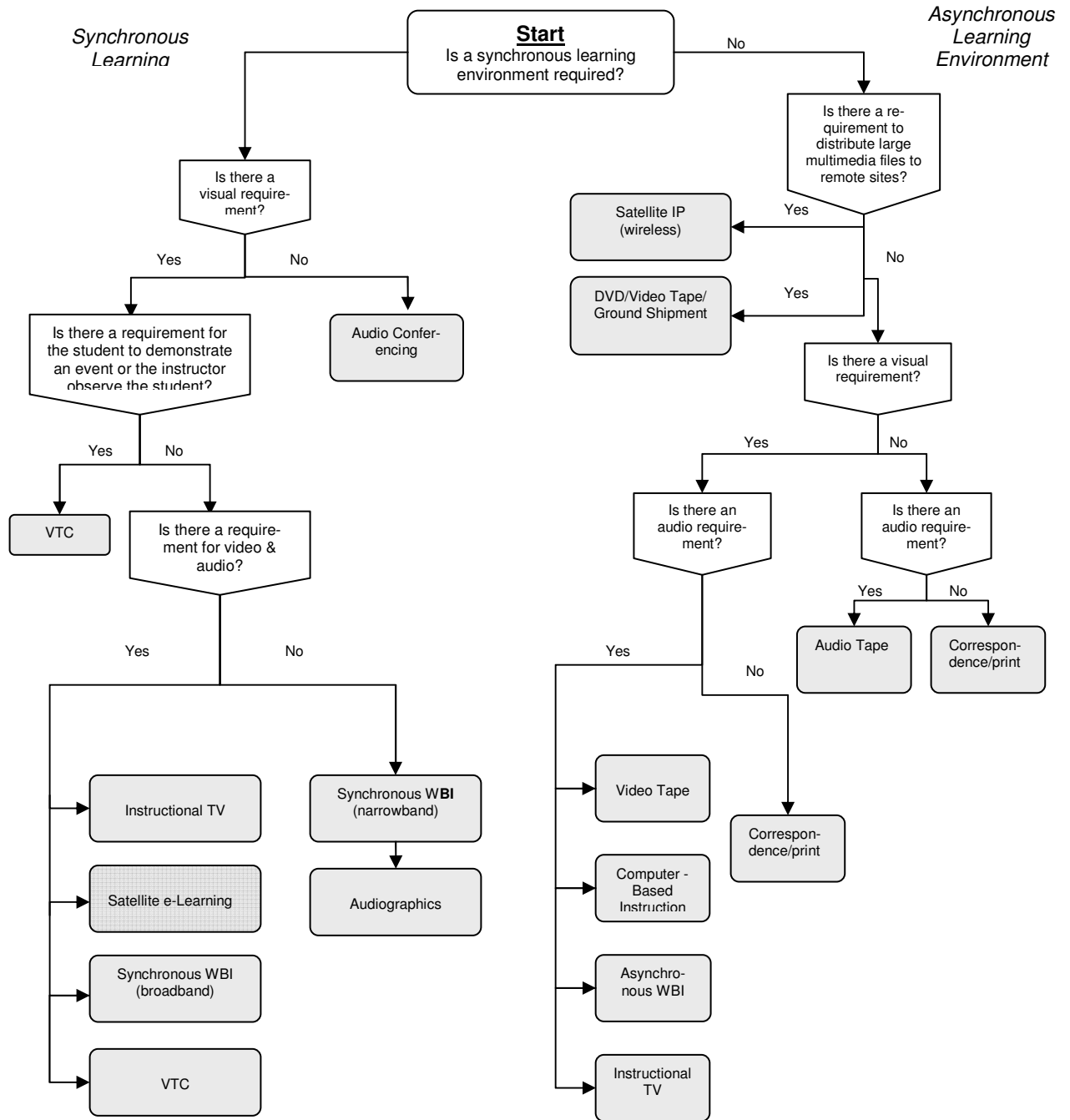
and technique, the selection of appropriate technologies, and the quality of interaction afforded to learners.

The authors concur in that the most significant factors in student learning are *quality and effectiveness of instruction,* and the most important *single* factor in media selection is the *instructional objective,* with the end result of improving human performance. The level of cognitive objectives is a critical variable to consider when selecting the most appropriate media, whereas:

- Asynchronous media may be more appropriate for the lower cognitive levels where knowledge and comprehension and repetition/drill & practice are the primary focus, and
- Synchronous media may be more appropriate for the higher cognitive levels (synthesis/analysis/evaluation) where a synchronous learning environment is required to support a high level of interaction (dialog)

In conclusion, it is important to remember that instructional media are basically distribution systems, and *the most critical consideration in selecting a medium is the preservation of instructional effectiveness.*

Distance Learning Instructional Media Selection Matrix

Synchronous Learning

Asynchronous Learning Environment

Start
Is a synchronous learning environment required?

No

Is there a requirement to distribute large multimedia files to remote sites?

Is there a visual requirement?

Yes

No

Satellite IP (wireless)

Yes

No

DVD/Video Tape/ Ground Shipment

Yes

Is there a requirement for the student to demonstrate an event or the instructor observe the student?

Audio Conferencing

Is there a visual requirement?

Yes

No

Yes

No

VTC

Is there a requirement for video & audio?

Is there an audio requirement?

Is there an audio requirement?

Yes

No

Yes

No

Yes

No

Audio Tape

Correspondence/print

Instructional TV

Synchronous W**BI** (narrowband)

Yes

No

Video Tape

Satellite e-Learning

Audiographics

Computer - Based Instruction

Correspondence/print

Synchronous WBI (broadband)

Asynchronous WBI

VTC

Instructional TV

Note: The level of required interactivity will lead the designer to choose a medium or set of media with appropriate symmetry to effectively and efficiently deliver instruction.

About the Authors

Jolly T. Holden, Ed.D.

Dr. Jolly T. Holden serves as an Adjunct Faculty to the School of Education, American InterContinental University Online Master's of Education degree program in Instructional Technology. Previously, he held positions as the Senior Projects Manager for Training and Development, StarBand Communications Inc., Chief Learning Strategist at Spacenet Inc. and GE Spacenet, and was the Executive Marketing Manager for Distance Learning at AT&T Tridom. Upon receiving his Doctorate in Education from the University of Southern California in 1984, he became Chief of the Evaluation and Technology Branch and Graduate Education Program Manager for the Air Force Institute of Technology until his retirement from the Air Force. For the past 12 years, he has been actively involved in researching and promoting distance learning throughout the federal government and corporate community. He is widely recognized as one of the industry leaders in developing the distance learning market for the federal government, and in 1995 co-founded the Federal Government Distance Learning Association. He is currently on the Board of Directors and the Executive Committee of the United States Distance Learning Association (USDLA), and has served continuously on the Board since 1996 where he was past-president and former Chairman of the Board. He is also an Emeritus Industry Fellow to Ball State University's Center for Information and Computer Sciences, and serves on the Board of Advisors for The Education Coalition. In prior years, he served on the Board of Trustees for the Webb Foundation, the Board of Directors for the Federal Government Distance Learning Association (FGDLA), the TeleCon Advisory Board, and the Georgia Distance Learning Association Board of Advisors. During the past 12 years, Dr. Holden has keynoted several distance learning conferences, conducted workshops on distance learning, and chaired numerous learning and technology tracks at prominent education and training conferences. He has been listed in the Who's Who in Teleconferencing since 1996, and in 2002 was recognized by Learning & Training Magazine as one of the top 10 e-learning champions in the US. In 2001 he was inducted into the USDLA Hall of Fame, and based on his contributions to promoting distance learning in the Federal Government, was also inducted into the FGDLA Hall of Fame.

Philip J.-L. Westfall, Ph.D.

Over the past fourteen years, Dr. Phil Westfall has been become a leader in distance learning within the Air Force. Phil began government service in 1974 as an Air Force officer. He served as an aviator of tactical fighter aircraft, served as professor of French and flight instructor at the United States Air Force Academy, and in 1990, he was assigned to the Air Force Institute of Technology. There, Phil established and directed the Center for Distance Education and created an interactive television (ITV) network, the Air Technology Network (ATN), which now reaches over 150 receive sites (including Europe, Middle East, and the Pacific Rim) through 2 satellite uplinks linking 12 broadcast studios. After his retirement in 1994, he returned to the Air Force in Civil Service. The continuing expansion of ATN across the Air Force led to his present position as network director under the newly formed Air Force Institute for Advanced Distributed Learning. His pioneering efforts and active promotion of ITV within the Federal Government led to the establishment of an interagency ITV network, which he named the Government Education & Training Network (GETN). From a single uplink at AFIT in 1992, GETN has grown into a network of 12 uplinks used by 18 government agencies reaching over 1,300 downlink sites.

Phil is Chairman Emeritus of the Board and formerly President of the United States Distance Learning Association, the leading professional association in the field of distance learning. He was president (and co-founder) of the Federal Government Distance Learning Association, a chapter of the USDLA. Phil is also on the Executive Committee of the Government Alliance for Training & Education, a government organization that promotes the use of distance learning within the Federal sector. He is on the Editorial Board of the American Journal of Distance Education, the Board of Advisors of the Chief Learning Officer magazine, and on the Board of Advisors of Satellite Application Conference & Expo (SATCON). A frequent speaker at various distance learning conferences, he has also participated in developing sessions in distance learning for conferences such as SATCON, Training and Online Learning Expo & Conference, the Interservice/Industry Training, Simulation & Education Conference, and the Government Learning Technologies Symposium.

Phil is the recipient of the Air Force Association's Schriever Award for the Advancement in Aerospace Power and Technology. He is a member of the USDLA Hall of Fame, and is also the first military member inducted into the Teleconfer-

encing Magazine's Hall of Fame. Phil also received the FGDLA Outstanding Distance Learning Network for the year 2000. Phil is a member of Phi Kappa Phi, an academic honorary society. Phil earned a Ph.D. in Educational Metrics and Humanities Education from Ohio State University, a M.A. in Foreign Language Education, and a B.S. in Industrial Technology.