An Instructional Media Selection Guide for Distance Learning—

Implications for Blended Learning

Featuring an Introduction to Virtual Worlds

Second Edition

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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. On the contrary, it 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.

In the past, many associated instructional technology with instructional media since there was little distinction between the two terms. Instructional media was generally defined as being the physical means by which instruction was presented to learners. However, with the emergence of computer-mediated and internet/web-based technologies, the term instructional technology has taken on a much broader meaning. In their book on *Trends and Issues in Instructional Design and Technology*, Robert Reiser and John Dempsey (2011) defined instructional technology as:

> "the analysis of learning and performance problems, and the design, development, implementation, evaluation and management of instructional and non-instructional process and resources intended to improve learning and performance in a variety of settings, particularly educational institutions and the workplace[1]."

Consequently, based upon the current definition of instructional technology, instructional media selection becomes an integral component of the Instructional Systems Design process. In that role, media selection ensures that a specific instructional medium can support the attainment of a given learning objective. 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. 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	contains an introduction to distance learning and includes definitions, general constructs, a historical timeline tracing the evolution of distance learning in the United States, and the "family tree" of distance learning.
SECTION III	consists of a table of instructional strategies that can be used in either a synchronous or asynchronous learning environment.
SECTION IV	provides an introduction to instructional media options for distance learning that 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 in

[1] Reiser, Robert A., & Dempsey, John V. Eds. (2012). *Trends and Issues in Instructional Design and Technology* (3rd ed). Boston, MA: Pearson Education

	selecting the most appropriate medium or set of media for distance learning.
SECTION V	is a comprehensive description of the instructional media including the strengths and weaknesses of specific media and the applicable instructional strategies.
SECTION VI	discusses blended learning and includes definitions from several different perspectives, introduces the concept of synchronicity and elasticity, and proposes a tri-dimensional blended learning model.
SECTION VII	introduces the emerging virtual world application with a comprehensive discussion on the attributes and strengths of the virtual learning environment.

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 *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. As defined by *American Journal of Distance Education (1987),* 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*[2]*.* Alternatively, 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 definition that emerged was elegant in its simplicity: distance learning was defined as *structured learning that takes place without the physical presence of the instructor*[3]. This definition has been adopted by Department of Defense[4] and the *Federal Government Distance Learning Association.*

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

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[2] Garrison, D. R., & Shale, D. G. (1987). Mapping the boundaries of distance education: Problems in defining the field [Electronic version]. American Journal of Distance Education, 1(1). Retrieved February 16, 2006, from http://www.ajde.com/Contents/vol1_1.htm#abstracts

[3] Alexander, J. B., Andrews, A. E., Hamer, N. D., Keller, J. W., Trainer, M. S. (1989). Distance learning conference proceedings. Los Alamos, NM: Los Alamos National Laboratory.

[4] Undersecretary of Defense for Personnel & Readiness. (2006). *DoDI 1322.26, Development, Management, and Delivery of Distributed Learning*. Retrieved April 14, 2010, from http://www.dtic.mil/whs/directives/corres/pdf/132226p.pdf

online learning. Emerging from this was a new set of terms born out of the internet: *Web-based instruction*, *Web-based learning*, *Web-based training*, *online learning*, *distributed learning*, and the most prominent 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*.

Although the term e-learning was coined in 1998, the term appears to have been used as early as 1997[5]. Even though the term *e-learning* was defined by the American Society for Training & Development (ASTD) as *covering a wide set of applications and processes, such as Web-based learning, computer-based learning, virtual classrooms, and digital collaboration. It includes the delivery of content via Internet, intranet/extranet (LAN/WAN), audio- and videotape, satellite broadcast, interactive TV, CD-ROM, and more*[6], the marketplace has generally accepted it as applying only to the Internet. As a result, even this term has taken on different meanings, depending on the organization defining it, and has been variously defined as:

- the facilitation of learning via electronic media or through the Internet or an intranet[7]
- Internet-enabled learning[8]
- Instructional content or learning experiences delivered or enabled by electronic technology[9]

With rapid advancements in web-based collaborative tools, the next generation of e-learning emerged, e.g., e-Learning 2.0, which has been defined as *the idea of learning through digital connections and peer collaboration enhanced by technologies driving Web 2.0 users empowered to search, create, and collaborate in order to fulfill intrinsic needs to learn new information*[10]

Given the numerous definitions of what appears to be essentially the same construct, what are the necessary and sufficient elements of distance learning? On a practical level, for an activity to be considered *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
- 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

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[5] Cross, Jay. (2004). An Informal History of eLearning. On the Horizon. Vol: 12 Issue: 3 pp: 103-110, as cited in *Defining eLearning* (2007). Retrieved from http://www.nwlink.com/~donclark/hrd/elearning/define.html

[6] ASTD, (2009). Retrieved from http://www.astd.org/LC/glossary.htm

[7] BNET Business Dictionary: Retrieved from http://dictionary.bnet.com/definition/E-learning.html?tag=col1;rbDictionary

[8] Society for Applied Learning Technology, (2003). www.salt.org/glossary.asp

[9] *A Vision for e-Learning: Report of the Commission on Technology & Adult Learning*, (2001). Retrieved from http://www.nga.org/Files/pdf/ELEARNINGREPORT.pdf

[10] e-Learning Guild Research Report on *e-Learning 2.0—Learning in a Web 2.0 World,* Sep 2008

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.

It should be noted the term *distributed learning* evolved from the definition of *distance learning* but refers to only technology mediated instruction. As defined by the Department of Defense Instruction, *distributed learning* is *structured learning mediated with technology that does not require the physical presence of an instructor*[11].

The Emergence of Distance Learning

Although this quote sounds as if it were referring to a new technological breakthrough, in reality, this statement was uttered by the Reverend Joseph H. Odell, D.D., delivered in November of 1910 at the dedication of the instruction building of the *International Correspondence Schools* in Scranton, PA.

> ***"I do not know any innovation upon existing methods more radical and revolutionary than this"***
>
> *The New Era in Education: A Study of the Psychology of Correspondence Methods of Instruction*

One can follow the evolution of distance learning in the United States from the late 19th century, where it was rooted in correspondence, to the adaptation of communication media (radio and TV) in the mid-20th Century, and 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.

In the early years of distance learning in the United States, the choice of instruction media to deliver education was limited. However, as the country grew and evolved from an agrarian society into an industrialized nation, the demand for education increased significantly. With the ensuing emergence of radio and TV, the education community quickly realized the potential of these new media and adopted them to distribute educational programs to a geographically dispersed workforce. Then, as the technology evolved, more delivery tools emerged to where the instructional designer now has a plethora of choices of media that can be used singularly or integrated to create a blended learning solution.

[11] Department of Defense Instruction (DODI) 1322.26 (June, 2006)

With the introduction of the computer, learning communities quickly realized the potential of this powerful new technology and adopted it as another delivery tool. As the computer continued to evolve, a new generation of the computer-mediated instruction arrived, and with the emergence of the Internet, new collaborative tools and delivery media also appeared.

It should be noted that in the early 90's, a migration began from a mainframe-centric environment to a more of a stand-alone "distributed" computer environment that allowed for more local hosting of computer-based training (CBT).

Change is inevitable, and tomorrow will bring newer and better technologies, accompanied by a new set of challenges, but the goal is the same: to optimize the technology without sacrificing instructional quality. In the end, incorporating sound instructional design principles provides a solid foundation to ensure learning outcomes are attained.

The Arrival of Blended Learning

As in *distance learning*, *blended learning* (or *hybrid learning*) has its basis in the instructional design process. Although the application of blended learning has been around for decades, it is nothing more [or less] than employing a variety of media and methods.

> ***"It is likely not the 'blendedness' that makes the difference, but rather the fundamental reconsideration of the content in light of new instructional and media choices."***
>
> *Richard Voos, Blended Learning-What is it and where might it take us? Sloan-C View, Volume 2, 2003.*

Even though the concept of *blended learning* has been around for many years, there is no universally accepted definition; most often, it is used to define a curriculum that includes portions of traditional classroom instruction with other portions accessed on-line. It can also refer to the use of multiple media—synchronous or asynchronous—to achieve an optimal integration of instructional methods based upon sound instructional design. From an instructional design perspective, it is not a novel idea. But why, then, did the term emerge? As Jack Gordon, Editor-at-Large of *Training* magazine, put his finger on it when he said in the July 2005 issue, *the 'Internet-is-going-to-eliminate-face-to-face-training' paradigm 'has exploded,'* and, *the term 'blended learning' was coined by the e-learning protagonists as a way of admitting that classroom instruction is not going away*. Janet MacDonald of Open University (UK) agrees: *Blended learning seems to have arisen from a general sense of disillusionment with the stand-alone adoption of online media."*[12] *Blended Learning* is merely a concept that argues that we should *think outside the Web*. The lesson is plain: one should not select media before identifying objectives. As Dr Tony Alessandra has often quipped, *prescription before diagnosis is malpractice*! For the purposes of this guide, then, *blended learning* refers to the appropriate combination of instructional media to achieve learning objectives.

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[12] MacDonald, Janet (2006). Blended Learning and Online Tutoring: A Good Practice Guide. Burlington, VT: Gower Publishing Limited

Figure 1: The Historical Timeline of Distance Learning

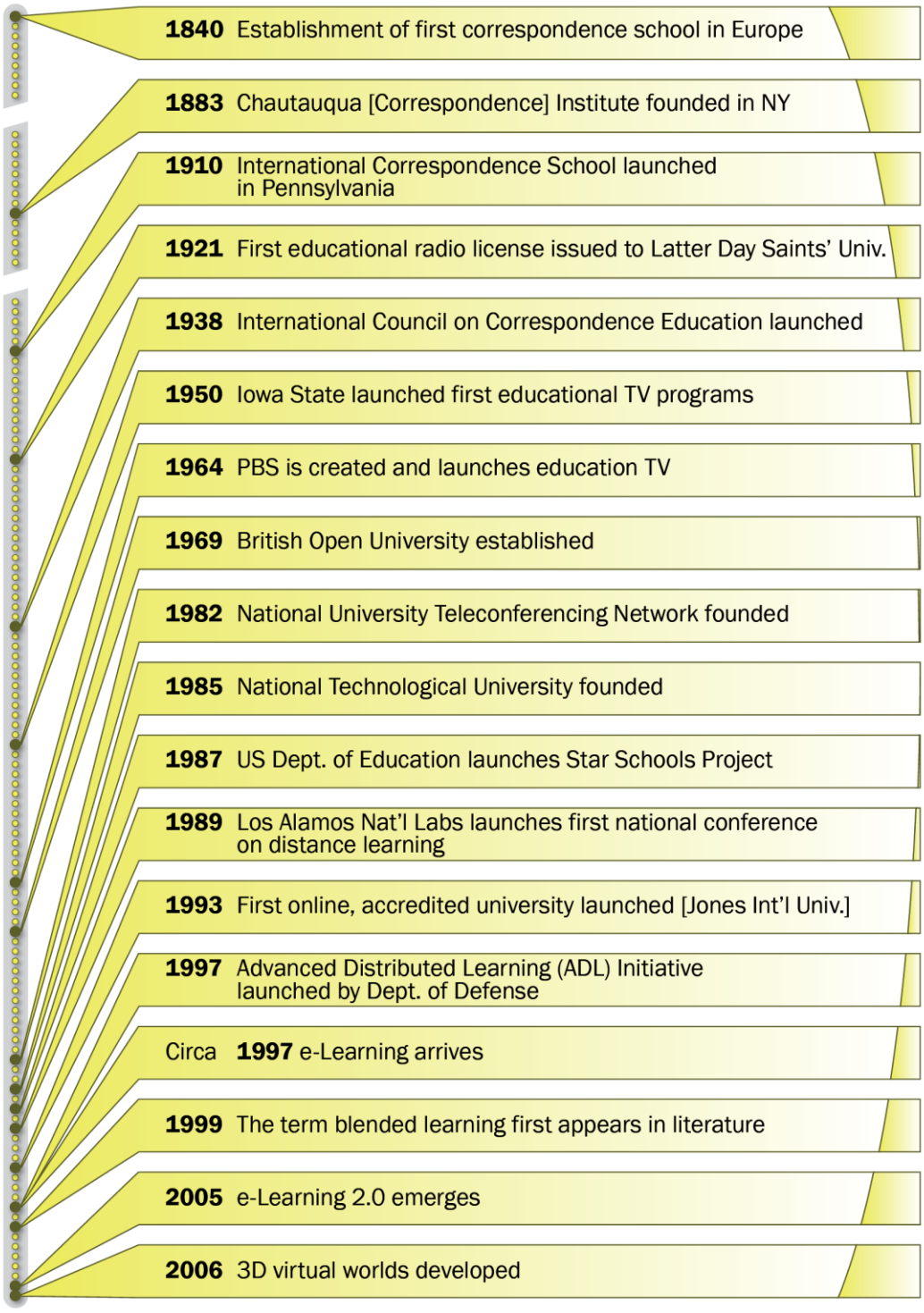
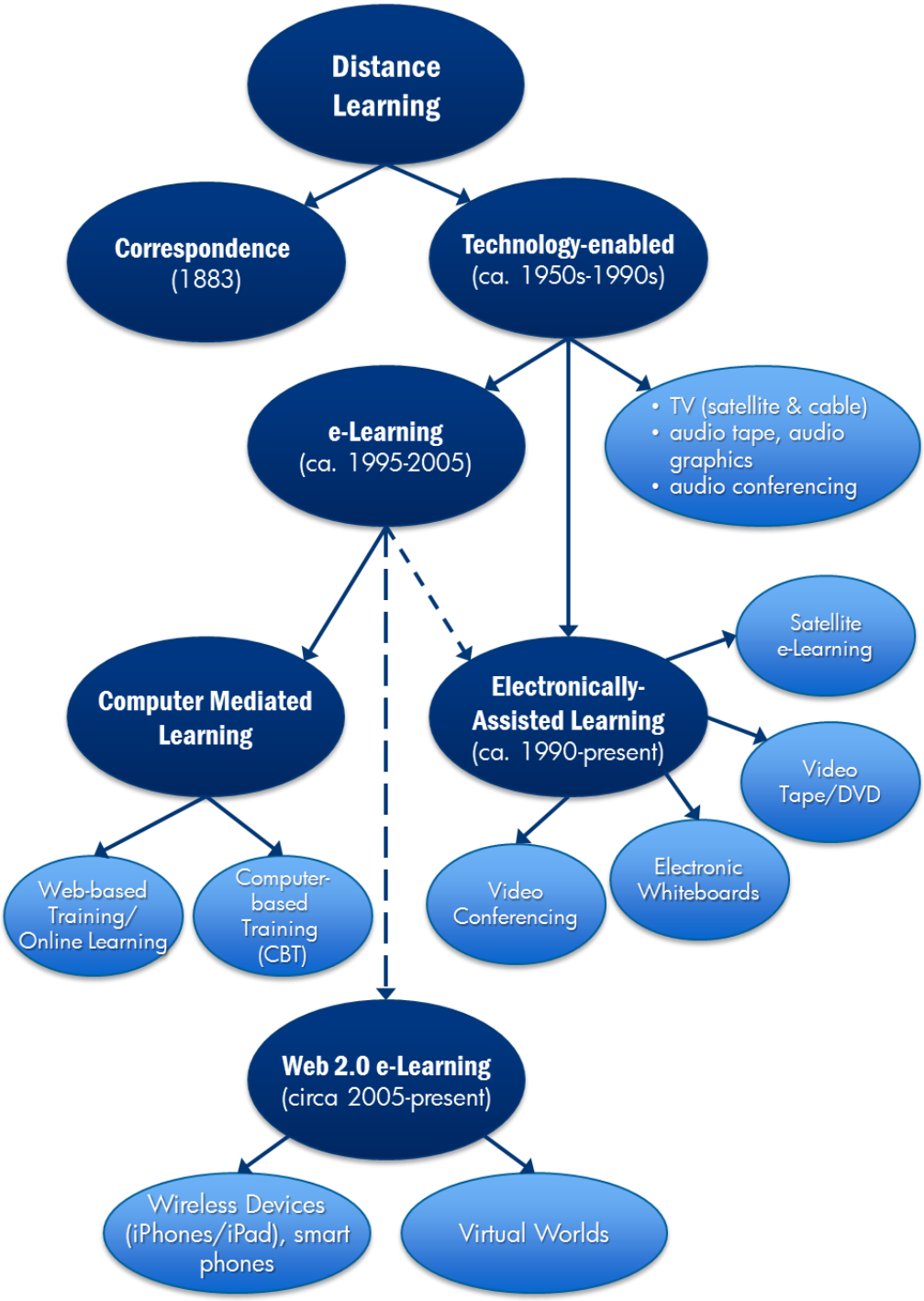


Figure 2: The Family Tree of Distance Learning



INSTRUCTIONAL STRATEGIES SUPPORTING DISTANCE LEARNING

The dissemination of content through the use of distance learning media is only as effective as the quality 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. To that end, the transfer of knowledge is facilitated by the development of effective instructional strategies.

Scholars have identified learning to be primarily a social, dialogical process. Social learning theory suggests that most learning takes place in a social context where learner behavior is modeled by others. This modeling can occur through lecture, guided discussion, role-playing, case study, 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. 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 instructional media are selected based on specific learning objectives? By combining the *Distance Learning Instructional Media Selection Matrix* (Figure 12) with the *Table of Instructional Media Delivery Options for Distance Learning* (Table 3) 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 there are multiple learning objectives, it follows that finding the right medium-to-objective match will likely result in a blended media approach.

Instructional Strategies vis-à-vis Cognitive Strategies

While instructional strategies focus on the transmission of knowledge and describes the general components of a set of procedures used to enable student mastery of learning outcomes, cognitive learning strategies are methods used to help learners link new information to prior knowledge[13]. To that end, cognitive strategies focus on how the learner processes knowledge and provides a structure for learning through mental strategies, and these are used to facilitate the activation and retention of prior knowledge by integrating active and exploratory learning techniques into the design process.

[13] Driscoll, Marcy P. (2005). Psychology of Learning for Instruction. Pearson.

Impact and Variability of Learning/Cognitive Styles

The recurring debate concerning the efficacy of learning styles and their impact on learning outcomes have been addressed in the literature for the past 60 years. The research, however, has not overwhelming supported the hypothesis that learning styles are useful in determining the most appropriate instructional media to deliver content. The majority of research does not support a significant statistical relationship between learning/cognitive styles and learning outcomes. Simply stated, the research has not shown that learning styles have a significant effect on learning outcomes[14].

With that said, much has been made of individual preferences and styles of learning. And not without good reason: teachers notice that students vary greatly in the speed and manner with which they pick up new information and concepts, and the confidence with which they process and use them[15].

Unfortunately, the concept of learning/cognitive styles is one of the most misunderstood and misused concepts in the education and training communities today. One of the reasons is lack of understanding of the complexity of human brain functions, as they relate to learner modalities in receiving information (i.e., visual, aural, kinesthetic), and how the brain processes that information (cognition). Research in neuroscience is discovering how the brain processes information acquired through our primary learning modalities: visual, aural, and kinesthetic—and the results may appear counterintuitive.

One important finding from that research is that memory is usually stored independent of *any* modality. Research shows that learners typically store memories in terms of meaning—not in terms of whether they saw, heard, or physically interacted with the information[16]. For example, retention has been shown to improve when words and pictures are used together, instead of using words alone[17].

Adding to the confusion is the lack of distinction often made between *learning modalities* and *learning styles*—the terms are often used interchangeably. *Learning/cognitive styles* are *habitual ways of processing information to memory*; they are ways learners sense, think, solve problems, and remember information. Conversely, *learning/perceptual modalities*, are sensory based, and refer to the primary way learners take in information though the senses: *visual*, *auditory*, *kinesthetic*, and

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[14] Harold Pashler, Mark McDaniel, Doug Rohrer, and Robert Bjork, (2008). Learning Styles: Concepts and Evidence, Psychological Science in the Public Interest. Retrieved from http://www.psychologicalscience.org/journals/pspi/PSPI_9_3.pdf

[15] Frank Coffield, David Moseley, Elaine Hall, Kathryn Ecclestone, (2004). Should we be using learning styles: What research has to say to practice. Learning Skills and Research Centre, London. Retrieved from http://www.ttrb.ac.uk/attachments/c455e462-95c4-4b0d-8308-bbc5ed1053a7.pdf

[16] Daniel Willingham, (2005). Do Visual, Auditory, and Kinesthetic Learners Need Visual, Auditory, and Kinesthetic Instruction? American Educator, Summer 2005

[17] Mayer R.E. & Moreno R. (2003) *Nine ways to reduce cognitive load in multimedia learning*. In Web-Based Learning: What Do We Know? Where Do We Go? (eds R. Bruning, C.A. Horn & L.M. PytlikZillig), pp. 23–44. Information Age Publishing, Greenwich, CT.

tactile. It should be noted neuroscience has revealed that 90% of what the brain processes is visual; it is undeniable that for unimpaired learners, their primary modality is visual.

While there is a commonly held belief that learning styles affect performance[18], there is continued debate as to whether learning styles even exist, and the only current evidence of their existence are the results from tests used to identify them.

Research has revealed a wide disparity in the definition of learning styles and their relationship to cognitive styles. Cognitive styles are viewed as a bipolar dimension representing a person's typical or *habitual* mode of problem solving, thinking, perceiving, and remembering; and these modes are considered stable over time. Studies in these areas are found primarily in theoretical or academic research. Learning styles, on the other hand, are defined as multidimensional, and these are usually not "either-or" extremes. Styles reflect how information is preferentially perceived (sensory or intuitive), organized (inductive or deductive), processed (active or reflective), and modality preference (visual, aural, or kinesthetic). Research has identified *over 71 different types of learning styles,* and low validity and reliability scores of the instruments used to identify specific learning styles raise serious doubts about their psychometric properties[19],[20].

In summary, cognitive science has revealed that learners differ in their abilities with different modalities, but teaching to a learner's best modality does not affect his or her educational achievement. What does matter is whether the learner is taught in the best mode for a specific type of content … Conclusion? Students learn more effectively when content drives the choice of modality.

Generational Differences

In a similar way that the concept of "learning styles" has led many instructional designers to select media based largely on a misperceived relationship with learning outcomes, the more recent focus on "The Digital Generation," is also proving itself to be misleading. In a recent issue of Chronicle of Higher Education (CHE)[21], in its The Millennial Muddle" article, Palmer Muntz, director of admissions at Lincoln Christian University is said to have asserted that *To accept generational thinking, one must find a way to swallow two large assumptions. That tens of millions of people, born over about 20 years, are fundamentally different from people of other age groups—and that those tens of millions of people are similar to each other in meaningful ways.* The same article reports that the University of California at Los Angeles' Cooperative Institutional Research Program, which has conducted annual surveys since 1966, shows changes are small and gradual—and differences are

[18] Sharp, J. G., Byrne, J., & Bowker, R. (2008). *The trouble with VAK*. Educational Futures Vol.1(1) August 2008. Retrieved from http://www.educationstudies.org.uk/materials/sharp_et_al_2.pdf

[19] *Learning styles and pedagogy in post-16 learning: A systematic and critical review*. Learning and Skills Research Centre, Department for Education and Skills, UK (200). Retrieved from http://www.hull.ac.uk/php/edskas/learning%20styles.pdf

[20] *Cognitive Styles and Distance Education*. Online Journal of Distance Learning Administration, Volume II, Number III, Fall1999, Retrieved from http://www.westga.edu/~distance/liu23.html

[21] *Hoover, E. (2009). The Millennial Muddle. Chronicle of Higher Education 11 October 2009*

not significant between generations, but only over multiple generations. Some disturbing trends that were over multiple generations were noted, however: an increasing sense of entitlement, decreasing literacy, and general factual knowledge.

In its September 2008 issue, The CHE published an article entitled "Generational Myth"[22]. Its author, Professor Siva Vaidhyanathan, claimed that *there is no 'Digital Generation.' Today's young people—including college students—are just more complicated than any analysis of imaginary generations can ever reveal.* The article went on to say those focusing on those "born digital" ignore *the vast range of skills, knowledge, and experience of many segments of society*, and ignores the needs *of the those who are not socially or financially privileged*. Professor Vaidhyanathan claims that familiarity with, understanding of, and dexterity with technology varies greatly within the 18-23 age group. A *few have amazing skills*, but *a large number can't deal with computers*. We must avoid *overestimating the digital skills of young people in general.* Thinking in generations too simplistic. The article goes on to state that *Once we assume that all young people love certain forms of interaction and hate others, we forge policies and design systems and devices that match those predispositions. By doing so, we either pander to some marketing cliché or force otherwise diverse group of potential users into a one size-fits-all system that might not meet their needs.*

In another CHE article[23], Bauerlein claims that The greatest disappointment of our time is that huge investments made in technology (beginning with Telecommunications Act of 1996) in public schools have met with negative results. In fact, he reports, reading proficiency dropped from 40% to 35% from 1992 to 2005. Addressing the use of the new popular technologies and applications, Bauerlein claims that leisure-time technical skills did not translate to educational and training use of technology. Intellectual habits such as deep reflection decrease with increase time spent on browsing, blogging, IMing, Twittering, and Facebooking. Fast scanning does not translate into academic reading. So it appears that the learner's familiarity with technology does not indicate how well he or she will perform in a distance learning environment . Our main point for designers is that they should not be distracted by whether their learners are part of a so-called Digital Generation, but instead should focus on designing instruction based on sound cognitive learning strategies.

[22] Vaidhyanathan, S. (2008). Generational Myth. Chronicle of Higher Education 19 September 2008

[23] Bauerlein, M. (2008). Online Literacy Is a Lesser Kind. Chronicle of Higher Education 19 September 2008

Table 1: 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 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, 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.
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 STUDY	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.

Instructional Media for Distance Learning

The instructional media selection process is a systematic approach and an integral component of the instructional systems design (ISD) process. 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. Using a systematic approach to media selection ensures that appropriate instructional media are employed to support desired learning objectives.

Media selection analysis must evaluate general and specific criteria, including instructional, student, and cost aspects for each delivery technology (or instructional medium) to ensure attainment of the instructional goal.

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
- Level and domain (cognitive, affective, psychomotor) of learning objectives
- Delivery issues to consider are:
- Audience size & distribution
- Cost
  - In house vs. outsourcing
  - Availability of existing infrastructure
  - Delivery - hardware endpoints
    - Video teleconferencing equipment
    - Satellite receivers
    - WAN/LAN system/connectivity
    - TV/monitor, display devices, servers/computers
    - Portability (smartphones, DVD players)

Synchronous versus Asynchronous Learning Environments

A synchronous learning environment supports live, two-way oral 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 video-conferencing technologies. Synchronous learning also incorporates these elements:

- Provides a dialectic learning environment with varying levels 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 exists when communication between the instructor and the student is not real-time. Examples of asynchronous instruction in a distance learning environment are the use of text materials (print or electronic), and online discussion boards where students respond to questions from the instructor or other students. Asynchronous learning also incorporates these elements:

- Provides for more opportunity for reflective thought
- Not constrained by either 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

An instructional media selection matrix (Figure 12) can be used to select the most appropriate media based on the entering arguments of the learning environment.

Social Media

For the purpose of this guide, the use of discussion boards, wikis, and blogs are not considered as instructional media delivery options, per se, but instead are viewed as *enabling technologies* used to support other instructional media in designing a blended learning solution. Often referred to as e-learning 2.0 or Web 2.0, these media components (wikis, blogs, and discussion boards) are primarily used as *collaborative tools* and not considered stand-alone instructional media delivery options. However, when integrated into a course or learning module supporting a *structured learning environment*, these social media tools can support active learning and knowledge construction through peer-to-peer interaction. Additionally, these tools can be used in an unstructured environment in supporting *informal learning*.

> **"In this global, networked world, several technologies including search engines, blogs, podcasts, Web 2.0 applications and virtual worlds such as Second Life will be used for learning."**
>
> *Ed Hoff, CLO IBM, Learning in the 21st Century: A Brave New World, CLO Magazine, April, 2008*

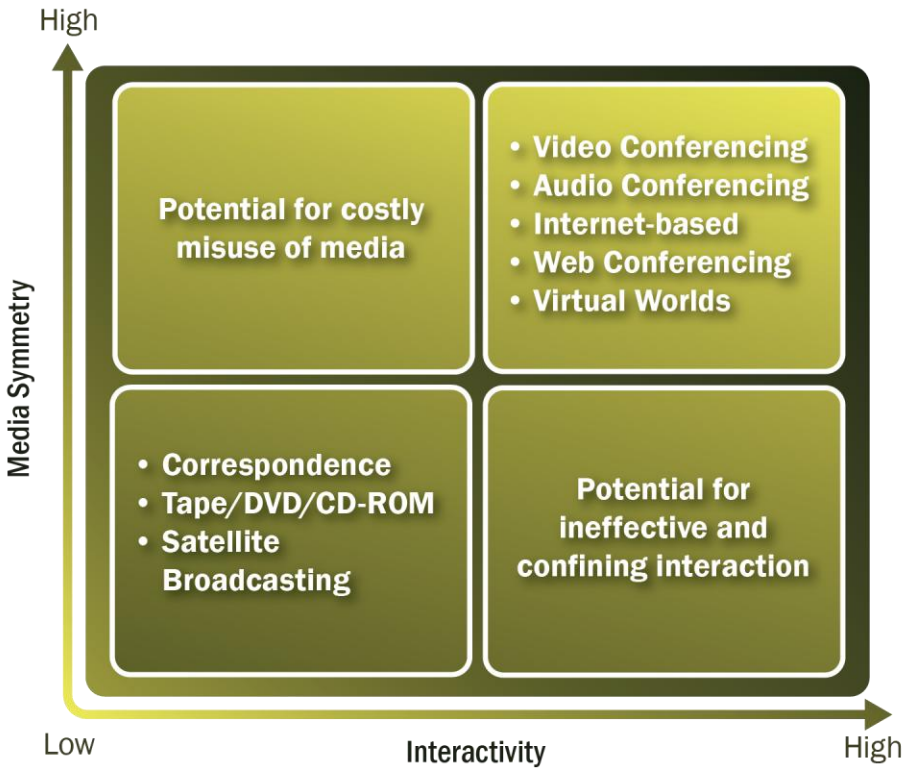
Symmetrical versus Asymmetrical Learning Environments

In distance learning, considering symmetry of the learning environment is almost as important as considering its synchrony. If not taken into account, course designers may make less than optimal choices from a financial and instructional perspectives.

Asymmetrical interaction occurs when the flow of information is predominantly in one 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 instruction is synchronous or asynchronous.

So 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 2). Combining one symmetrical technology an asymmetrical one is often effective. For example, delivery of content can be accomplished using satellite or print but the interactive aspect can be accomplished using audio conferencing or e-mail. With mobile devices, e.g., cell phones, smartphones, personal DVD players, etc., also consider symmetry—the amount of information [digital bits] that flows to and from the sender and receiver, to determine whether you are effectively using theses media as well.

Figure 3: Symmetry of Interactivity & Instructional Media



Taxonomy of Distance Learning Media

The *Taxonomy of Distance Learning Instructional Media Table* (Table 2) is designed to assist in determining the most appropriate medium for a specific distance learning application. The taxonomy is focused primarily on a dichotomous learning environment—the initial selection criterion being either *synchronous* or *asynchronous*, and will aid the instructional designer or subject matter expert (SME) in determining the most appropriate medium to be selected.

The instructional designer may choose a combination of media to meet the desired learning objectives.

Table 2: Taxonomy of Distance Learning Media

	Synchronous	Asynchronous
VISUAL ONLY (include graphics)		➡ Correspondence ➡ Pre-recorded video
AURAL ONLY	➡ Audio Conferencing	➡ Pre-recorded Audio
VISUAL & AURAL	➡ Instructional Television/Satellite e-Learning ➡ Video Teleconferencing ➡ Web Conferencing ➡ Audiographics ➡ Virtual Worlds	➡ Pre-recorded Video ➡ Computer Based Instruction ➡ Asynchronous Web Based Instruction (WBI) ➡ Instructional Television ➡ Virtual Worlds

Instructional Media Delivery for Distance Learning

An analysis of available technologies must include a thorough examination of the advantages and limitations that each presents within the learning environment. Consideration 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, responsiveness to changes in course content, efficiency of the delivery system, and total system cost.

The table below provides an explanation of the available media that can support the distribution of content for distance learning. In addition, Figures 4 and 5 reflect instructional strategies mapped to synchronous and asynchronous instructional media.

Table 3: Instructional Media Delivery Options

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 using 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 affected 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 is often supplemented by electronic or printed handouts. Can be integrated with other delivery systems to provide synchronous audio.
AUDIOGRAPHICS/ ELECTRONIC WHITEBOARD	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.

Technology Delivery	Description
PRINT	The oldest medium in distance learning, and consists of text and graphics in paper form—or *books*. Courses comprising primarily of printed material are called *correspondence courses* and exist as a stand-alone means of delivering instructional content. Although asynchronous and self-paced, such courses can be augmented through the use of multimedia CD-ROM. Instructor feedback can be facilitated through the use of e-mail. It should be noted that print is still one of the most used media world-wide, and often it is a major delivery medium in many on-line and in resident programs in the academic world.
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 or cable TV. 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 using an audio bridge and normal terrestrial phone service. This specific application would not be available to instructional 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/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.
RECORDED VIDEO (TAPE /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 remote student.

Technology Delivery	Description
SATELLITE E-LEARNING	Satellite e-learning represents the next generation of distributed media. Uses 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 video encoding 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 used at 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 multimedia/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 Television/Internet Protocol).
SYNCHRONOUS WEB-BASED INSTRUCTION (WBI)	Internet-based software and services delivered over the Web that enable synchronous audio or Web conferencing, text chat, audio, video, document and application sharing, whiteboards, presentations, etc. Can support synchronous oral interaction between the instructor and remote students at multiple locations as well as supporting a Multi-User Virtual Environment (MUVE) or webinars. Due to bandwidth limitations, high-resolution images and video may be limited.
VIDEO TELECONFERENCING (VTC)	VTC systems are two-way communication systems that offer both audio and video from local and remote sites and provide for synchronous interaction between the instructor and remote students at multiple locations. Allows for the instructor to observe the students at the far end (remote location), allowing the student to demonstrate a learning event. Systems can be terrestrial, satellite, or microwave-based Instructional TV Fixed Service (ITFS). Generally, VTCs transmit and receive between 384Kbps – 1.5Mbps, with the next generation coders/decoders (CODECS) being IP enabled.
VIRTUAL WORLDS	A virtual world is a graphically rich, persistent immersive online 3D simulation of either a real or fantasy world environment populated by avatars, which are pictorial or graphical representations of the human participants, engaged in collaborative activities. The persistent nature of the user-generated and maintained content and overall experience makes this medium unique. True to its constructivist learning, experiences in virtual worlds are user-controlled.

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…any combination of these 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. No single medium is inherently better or worse than any other medium, just as a truck is not inherently better or worse than a sedan—they are all vehicles that simply deliver content. As discussed later in this guide, the selection of the most appropriate media is not based solely on the attributes of each specific medium, but on other considerations as well.

> **"The best current evidence is that media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in nutrition… only the content of the vehicle can influence achievement".**
>
> *Richard.Clark, "Reconsidering Research on Learning from Media". Review of Educational Research, Winter, Vol. 53, No. 4, 1983, pp. 445-459*

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 online.

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 instructor facilitation and feedback. Since WBI is an asynchronous technology, the student 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 degree of computer literacy beyond 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 require 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) Demonstration Simulation Illustration Drill and Practice	Tutorial Case Study Modeling Role Playing

Audio Conferencing

Strengths: 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 & graphics, or online collaboration tools; can be integrated with ITV or satellite tools-learning to provide for two-way voice communication.

Weaknesses: Learners may have difficulty remaining engaged in course material delivered entirely via this medium. Limited to oral interaction only, does not support visuals. Consequently, cannot use 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 medium

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

Computer-Based Instruction (CBI)

Strengths: In CBI, instruction is not affected by bandwidth as much as other distance learning media. It can display large amounts of visual and aural information. CBI allows the use of 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.

Because 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 large 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 can be incurred if the content changes often. Distribution efforts may require additional resources to track distribution 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	Illustration
Case Study	Simulation
Role Playing	Drill and Practice
Demonstration	Tutorial

Print

Strengths: Printed materials, or textbooks, often referred to as *correspondence*, they are the epitome of anytime, anyplace learning media because they do not rely on any technological infrastructure to deliver or to view content. Printed materials are often complimented by multimedia (DVD, CD-ROM, videotape, audiotape) to enhance the learning event. Print has the ability to reach students who are widely dispersed and do not have Internet access. Print can provide inexpensive representation of static visuals such as charts, graphics, images, etc.

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 Study

Instructional Television (ITV)

Strengths: ITV has the ability to emulate a live classroom environment when coupled with audio conferencing or a key-pad response system. ITV can be a highly interactive (dialectic) learning environment. Because satellite is not constrained by bandwidth, it does not limit the instructor in the use of any medium used in a traditional classroom environment; it can ensure consistent delivery of content across geographical boundaries to a very large audience in a short period of time. Optional equipment such as DVRs, video scan converters, document cameras, etc., allow instructors to include video illustrations, display PC application screens, and "zoom in" on objects for classroom discussion. It can also provide high levels of synchronous oral interaction and immediate feedback to questions despite the distance between instructor and students. Thanks to the broadcast nature of satellite, the number of sites receiving the broadcast is technically unlimited, and is constrained only 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 for broadcasting. Satellite equipment requires a significant capital outlay and annual recurring costs for satellite transmission and equipment maintenance. Because it is predominately a live classroom transmission, learners are constrained by time and space requirements. 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 Study 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 by the learner. 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)
Case Study

Recorded Video (Tape, DVD, Vodcast)

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 learners, 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 Study
Illustration

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 support a traditional classroom environment, and it can ensure a consistent delivery of content across geographical boundaries to a large audience in a short 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. When used

for 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 Study	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) Guided Discussion Simulation	Case Study Demonstration Illustration

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. 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. Because 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 DVRs, 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 or is incompatible. Delays due to compression and decompression rates of video may result in video and audio that are 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 Study	Role Playing Panel Discussion Demonstration Drill and Practice

Virtual Worlds

Strengths: Virtual worlds have many of the same benefits of games and simulations. However, virtual worlds offer additional significant affordances as well.

Virtual worlds offer multiple users the benefit of synchronously testing concepts and ideas in the simulated environment without the constraints of the real world. Physics, physical limitations and risks disappear in virtual worlds, affording users the opportunity to observe, participate, and co-create with peers with only the boundaries that may have intentionally or inadvertently been built into the virtual world. This strength makes virtual worlds ideal for exploring complex, abstract concepts; potentially dangerous activities; and other experiences that are otherwise not possible in the real world. An equally important strength, virtual worlds enable the user to experience enhanced immersion through a graphically rich interface or environment, providing a space and place 'to go'. The sense of being someplace with other people diminishes the sense of distance often encountered in other types of collaborative media, such as teleconferences, webinars, and video teleconferences. Most importantly, however, meaningful immersion occurs through the navigational and representational avatar. Avatars are representations of the users and are used to navigate through the environment. Users develop attachments to their avatars with time invested in customizing the avatar's look, continued use of the avatar, and social interactions with other avatars. Many virtual worlds have powerful content creation tools that avatars can use for building things with other avatars. Since the virtual world and its contents remain "live," activities and effects of activities

continue to persist even after users have logged off. In this sense, the virtual world is similar to the real world and can be useful in providing users the opportunity to identify and solve problems that may have resulted while they were logged off. Finally, some virtual worlds are interoperable with Learning Management Systems which enable some degree of performance tracking. Virtual world experiences can, then, be integrated within an existing training curriculum.

Weaknesses: Virtual words are not a panacea. They are not the answer for every learning, training, or collaborative challenge. It is critical to conduct a thorough needs analysis to understand if virtual worlds are a suitable medium for the identified requirements. As a tool, virtual worlds are currently not built upon a common set of design standards and are not interoperable with other virtual world platforms; therefore, the act of navigating will differ from world to world and interactions cannot be shared across worlds. Since there is no 'one size fits all' virtual world, this is problematic for many reasons, not the least of which is the potential requirement to invest in more than one virtual world. Another downside is learners having to setup their accounts, customize their avatars, and learn to navigate each world separately. These can be time consuming activities—time that most would rather not repeat doing the same tasks again and would rather spend on actual content learning or other such tasks. Tracking performance in virtual worlds is in its early stages. Meaningful performance metrics are needed to begin to study the efficacy of a virtual world as a learning medium; however, the industry is struggling with how to capture performance in meaningful, useful ways. Solving this issue is crucial to the future of virtual worlds.

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

Figure 4: Synchronous Media Mapped to Instructional Strategies

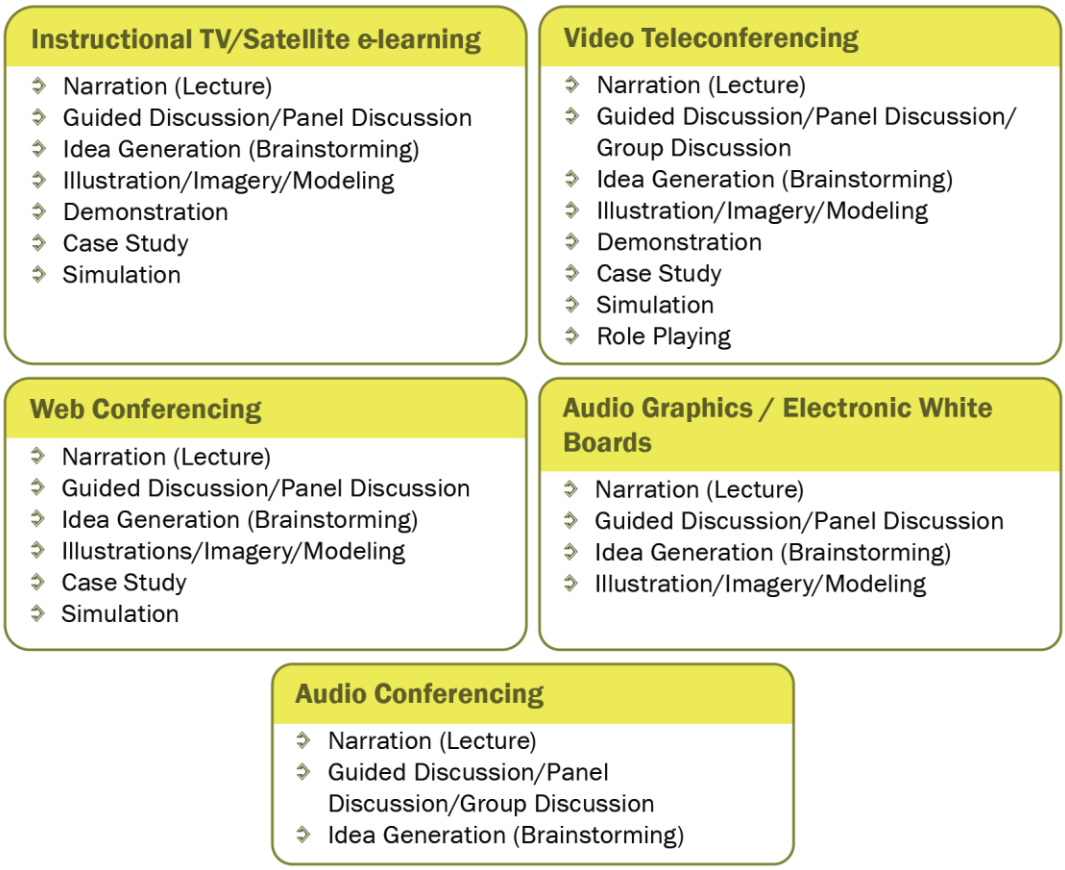
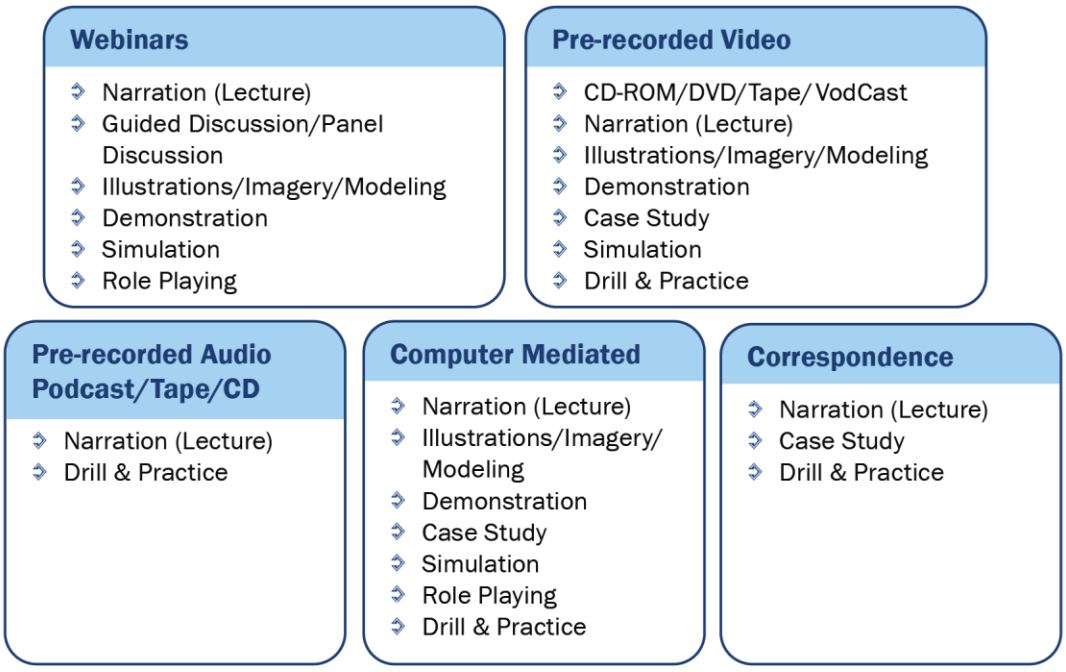


Figure 5: Asynchronous Media Mapped to Instructional Strategies



BLENDED LEARNING: INTEGRATING MULTIPLE MEDIA

As instructional media continue to evolve, propelled by advances in technology and fueled by the need to increase learning opportunities, the evolution and advancements of instructional media will continue to accelerate as well. As a result, blended learning will become an integral component in developing a comprehensive learning strategy.

While this Guide focuses primarily on selecting the most appropriate *instructional medium* supporting distance learning, blended learning involves selecting the most appropriate *instructional media* (multiple media) in supporting a learning solution. That is not to say distance learning is limited to a single medium, but when considering multiple media, substantially more constructs are taken into account.

> ***"Blended learning represents [a fundamental] shift in instructional strategy"***
>
> *North American Council for Online Learning, Blended Learning: The Convergence of Online and Face-to-Face Education, 2008*

Blended learning is more than just combining an online component to the traditional classroom…it is a *systematic process* of selecting the *most appropriate media* for a specific learning intervention based upon learning objectives.

With that said, given the plethora of instructional media available to the instructional designer today, combined with the emergence of web-based collaborative tools, there is a renewed focus on integrating e-learning 2.0 tools and other instructional media in meeting today's learning challenges.

Driven by the demand to increase learning opportunities and reduce costs without impacting instructional integrity, educators and trainers are continually challenged in searching for the for right mix of instructional media.

Taking into consideration all of the instructional technologies available today, selecting the right mix of live, virtual, and constructive courseware delivery methods in meeting the needs of our learners can be a challenging and daunting task. Consequently, when considering blending learning, two basic questions must be addressed:

Q1: What is the most appropriate mix of instructional media, and…

Q2: What are the variables to consider when selecting the most appropriate media?

Blended learning allows the instructional designer the opportunity to leverage the strengths of instructional media with the efficacy of the instructional components to ensure the instructional goal is attained. Therefore, for a blended learning solution to be *successful*, it is imperative a *thorough media analysis* and *needs assessment* be conducted while addressing the fundamental components of the instructional systems design process.

Blended Learning Concepts

Although delivery media do not affect the content, they can affect how you design the content. Media attributes are important because they may affect your choice of instructional strategies. Therefore, a set of guiding concepts should be applied when considering the most appropriate media:

- Asynchronous media are not adaptive to dynamic content
- Synchronous media can accommodate dynamic content
- Blended learning integrates multiple media with the appropriate instructional strategies, and can also include:
  - Collaborative tools used to facilitate the transfer of learning (discussion boards)
  - Adaptive tools used for dynamic content or increased interaction (blogs & wikis)

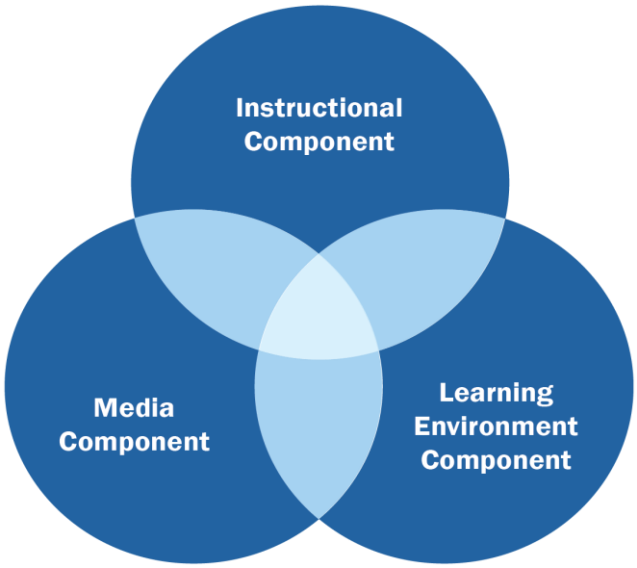
Note: While the most significant factors in student learning are quality and effectiveness of instruction, the most important single factor in developing blended learning is the instructional objective. The level of cognitive objectives is a critical variable to consider when selecting the most appropriate media for blended learning.

> ***"Collaborative online learning is now recognized as a component of a mature blended-learning strategy."***
>
> *Bersin & Associates, Technology Update: Open Source e-Learning Systems, June, 2007*

Blended Learning Model

Derived from the blended learning concept map is a blended learning module (Figure 6) depicting three major components: *Learning Environment*, *Instruction* and *Media*. A model can be a description of a system or phenomenon that accounts for its known or inferred properties and used for further study of its characteristics. Therefore, a blended learning model can be used as a guide in evaluating and integrating separate components that would result in an instructionally sound learning situation.

Figure 6: Blended Learning Model Components



Note: This model is based upon a set of *related* components, although evaluated separately, are viewed *holistically*, each component's specific contribution must be viewed as it relates to the sum total of all the parts, which results in a comprehensive blended learning solution. When developing a blended learning solution, the selection of the most appropriate media is *not based solely* on the attributes of the media, but the potential impact they may have on the design of the instructional components and its corresponding learning environment.

Learning Environment Component: A learning environment can either be synchronous or asynchronous. Each learning environment has its distinct set of advantages and disadvantages, and the goal of blended learning is to leverage those specific attributes of each environment to ensure the most optimum use of resources to attain the instructional goal and learning objectives.

Variables to Consider:

- Time & space
- Interaction
- Collaboration
- Pacing
- Flexibility in content delivery
- Timeliness of completion
- Reinforcement of ideas (immediate vs. delayed)
- Reflection on ideas

Instructional Component*:* Used to select the most appropriate instructional strategies that support the learning objectives (Instructional strategies are the products of learning objectives and serve to ensure the learning objectives and facilitate the transfer of learning). When developing blended learning, maintaining instructional quality is paramount. Consequently, learning objectives need not be compromised when developing a blended learning solution.

Note: Generally speaking, asynchronous media *may be* more appropriate for the lower cognitive levels, whereas synchronous media *may be* more appropriate for the higher cognitive levels. This relationship is particularly important when considering whether the learning environment is primarily didactic or dialectic (Table 4).

Variables to Consider:

- Level of interactivity
  - Spontaneity
  - Collaboration
  - Peer-to-peer
  - Instructor-student (didactic)
  - Instructor-student-instructor (dialectic)
- Cognitive load
- Reinforcement of ideas/thoughts (immediate/delayed)
- Rapidity of content change
- Complexity of content
- Level of cognitive objectives

Media Component: Media are vehicles that simply deliver content. Some instructional media, however, may be *more* appropriate than others in supporting either a synchronous or asynchronous learning environment, but no single medium is inherently *better* or *worse* than another. Whereas a given delivery medium may not alter the desired content, selection of a particular medium may affect

how you design the content to take advantage of unique attributes of that specific medium. Nevertheless, when *the most appropriate* media are selected, learning outcomes will not be affected—it is the instructional strategies employed that do.

Variables to Consider:

- Media richness (motion handling, visual clarity/pixel resolution)
- Dispersion of workforce/distribution of content
- Ability to update content quickly
- Technological infrastructure
- Capital & recurring costs
  - Bandwidth
  - Hardware end points
  - Portability
  - Simplex (one-way) data vis-a-vis duplex (2-way data)

Table 4: Bloom's Revised Taxonomy Mapped to Instructional Media

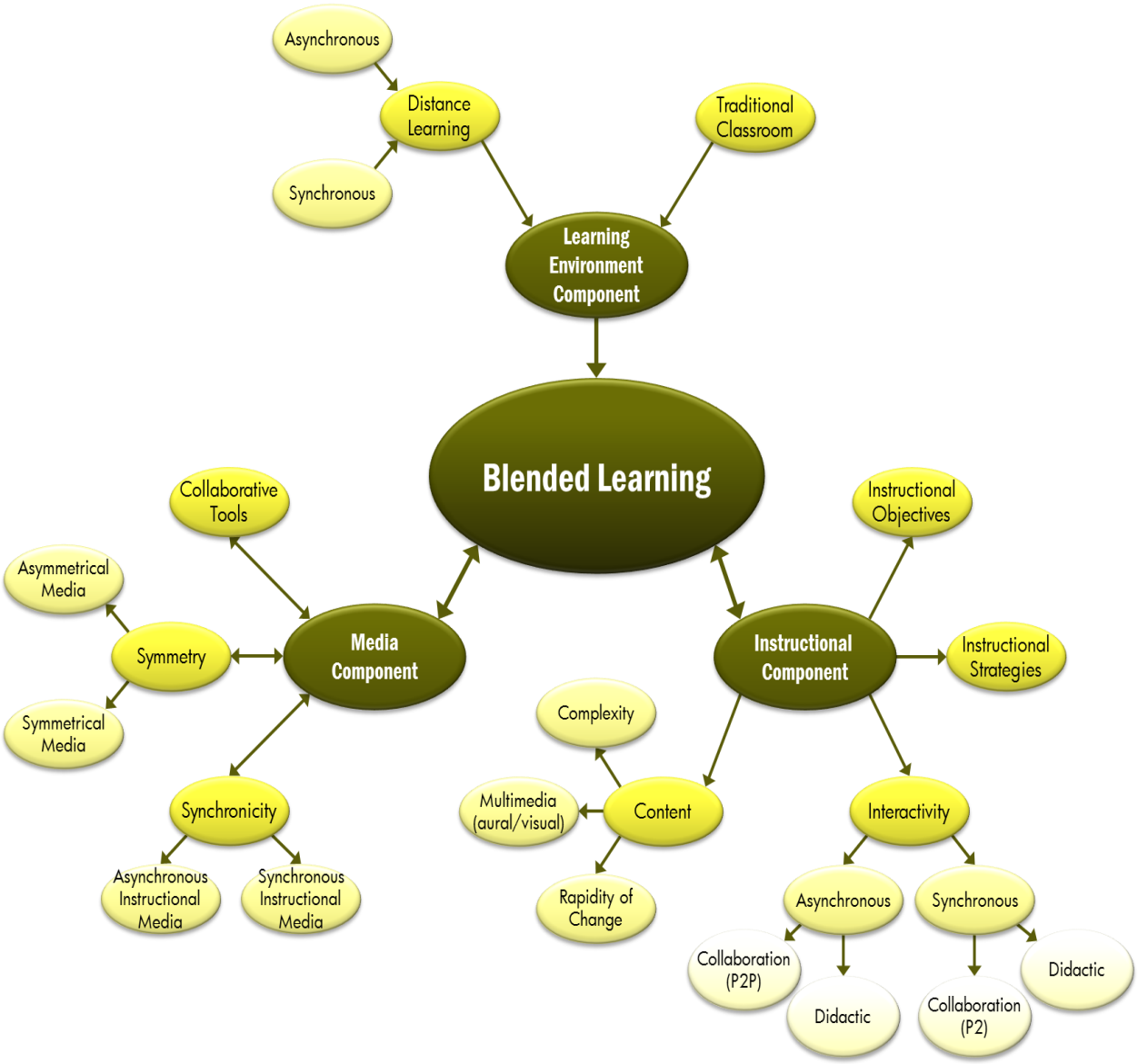
Learning Environment	Instructional Media	Bloom's Revised Taxonomy[24]	Level of Interactivity
Synchronous	• Web Conferencing • Audiographics • Satellite e-Learning • Audio/video teleconferencing • Virtual Worlds	Creating *evaluation* Evaluating *synthesis* Analyzing *analysis* Applying *application* Understanding *comprehension* Remembering *knowledge*	Dialectic  Didactic
Asynchronous	• Computer/Web-based Training (CBT/WBT) • Instructional TV (ITV) • Pre-recorded audio/video (CDs/DVDs, video/audio tapes/iPods) • Correspondence		

[24] Anderson, & Krathwohl, 2001, p. xxviii, as cited in Forehand, 2008. Bloom's Taxonomy. Retrieved from http://projects.coe.uga.edu/epltt/index.php?title=Bloom%27s_Taxonomy

Blended Learning Concept Map

Concept mapping is a way of graphically displaying concepts and relationships between or among concepts and is used as a visual aid in which to view thoughts and ideas. Concept mapping can aid in tying ideas together or seeing relationships between ideas. Depicted in Figure 7 is a blended learning concept map identifying the three main components and related subcomponents. The degree of integration of each of the subcomponents is based upon evaluating specific attributes of each, resulting in the most appropriate blend to ensure attainment of the instructional goal.

Figure 7: Blended Learning Concept Map



Concept of Synchronicity

Although synchronicity is dichotomous—being either synchronous or asynchronous, it does not mean its two attributes are mutually exclusive when considering a blended learning solution. If viewed as being on opposite ends of a continuum, the degree to which these two environments can be integrated would result in a *blending of synchronicity.*

Therefore, to attain the most optimum blend, one must consider the vehicle(s) that deliver the content, the learning environment in which the learning occurs, and the instructional objectives which drive the development of the content and instructional strategies. Figure 8 depicts the integration of synchronous and asynchronous media and learning environments which can result in a blended learning solution. There are no prescribed solutions to integrating media, and in many instances, there can be multiple blended learning approaches.

When developing a blended learning solution, some strategies may be more appropriate than others to achieve optimal learning. Therefore, in the context of media selection, when evaluating the most appropriate media, the following must be considered:

- Asynchronous media may be more appropriate for the lower cognitive levels where knowledge & comprehension, 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 9).

Note: Virtual worlds, by the very nature of their immersive learning environments, incorporate blended learning components that encompass both synchronous and asynchronous media.

Figure 8: Blended Learning—Integrating Multiple Components

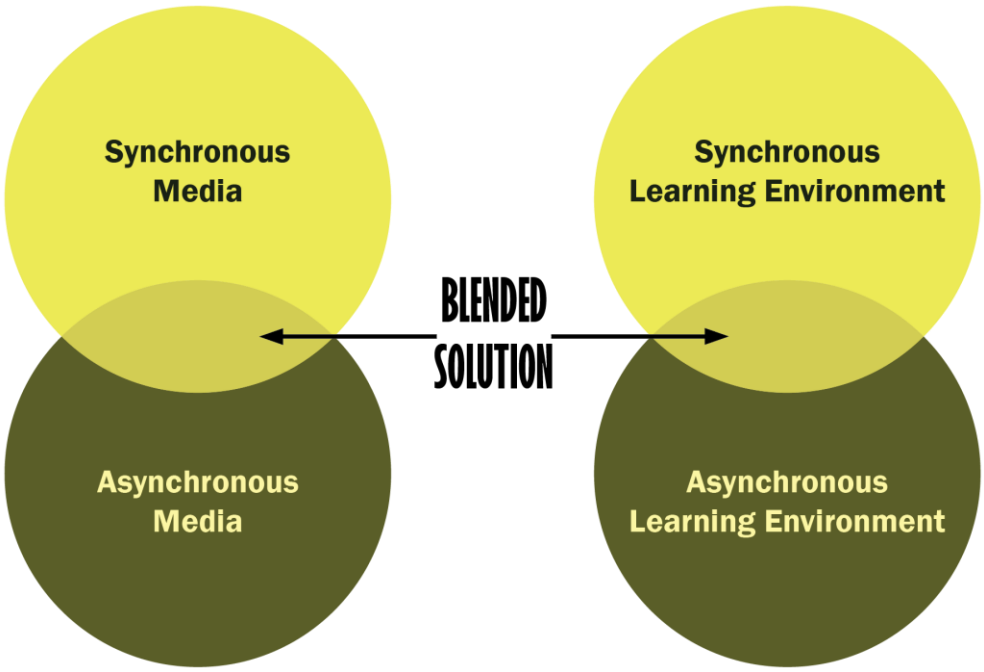
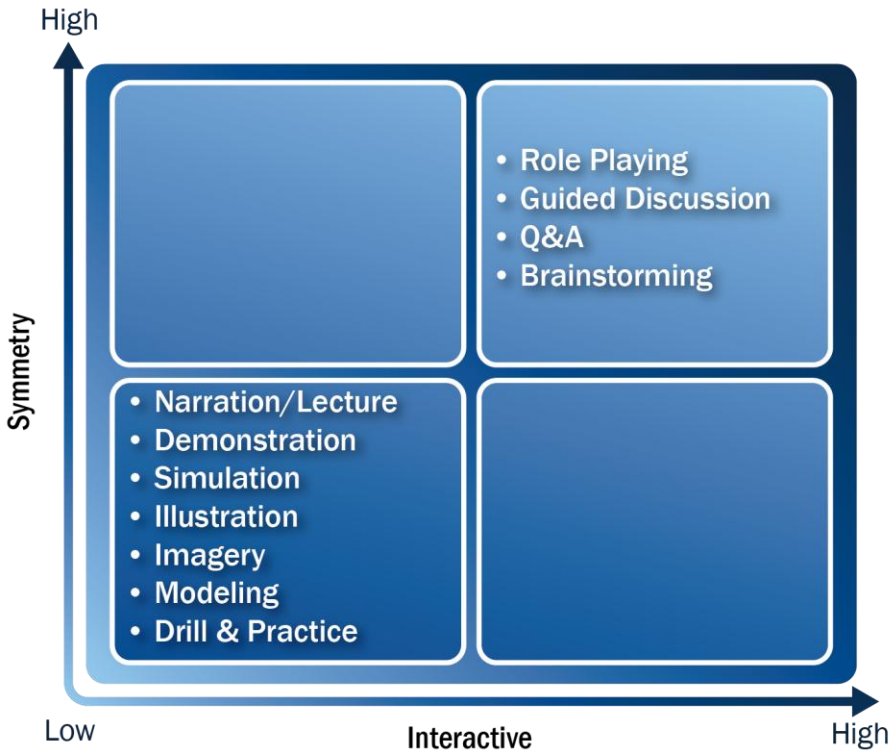


Figure 9: Symmetry of Interactivity & Instructional Strategies



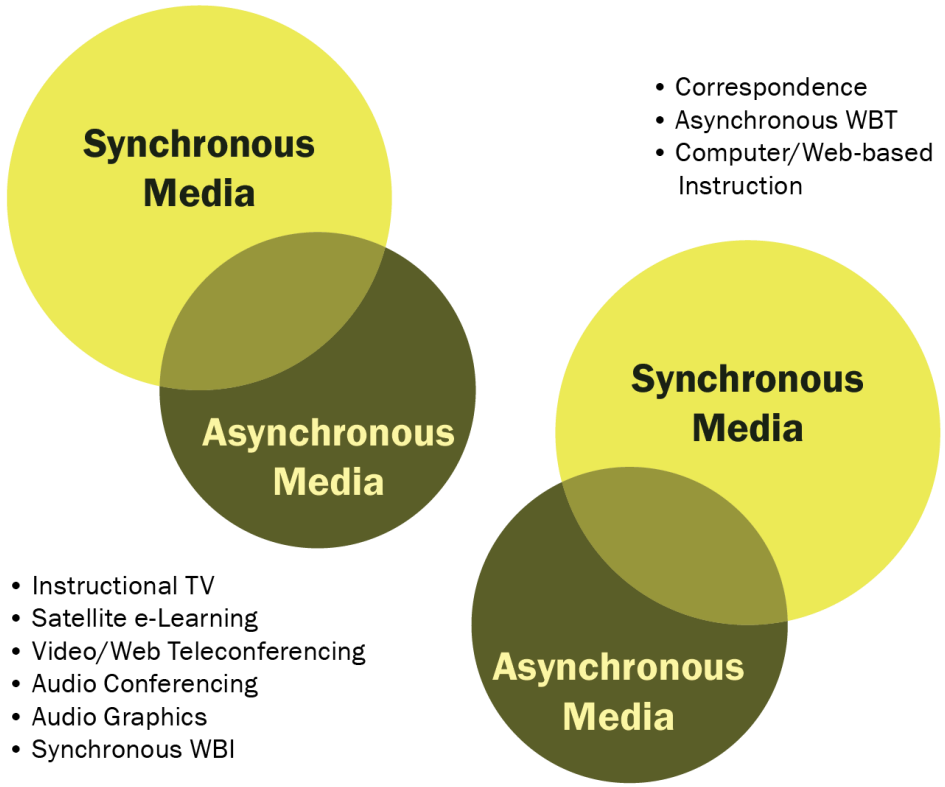
Concept of Elasticity

The economies of scale and power of blended learning are 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 10). Depending upon the cognitive level of the learning objectives and the learning environment (synchronous or asynchronous), different combinations of instructional media and instructional strategies can support various levels of interactivity to attain the most appropriate "blend." As the blend changes, the model becomes "elastic," allowing the instructional designer to modify the blend to meet specific learning outcomes.

What is the right mix? There may be several “blended” solutions that can meet the instructional objectives, so consider the qualitative merits of all instructional media. The ultimate goal is to increase performance through the systematic evaluation of intra-dependent variables that would result in the *most* appropriate integration of media. With that said, any combination of instructional delivery media, including the traditional classroom, can result in a successful blended learning solution, but the instructional efficacy of the solution is *most* dependent on the instructional and learning environment components.

Note: While virtual worlds support both synchronous and asynchronous learning, they would not be considered a blended learning solution as it applies to integrating separate stand-alone media.

Figure 10: The Elasticity of Blended Learning—Integration of Media



Introduction to Virtual Worlds

There is no single, agreed upon definition of "virtual world." However, all definitions acknowledge that a virtual world is an online simulation of either a real or fantasy world environment populated by avatars, which are pictorial or graphical representations of the human participants. A virtual world can also be described as "a synchronous, persistent network of people, represented as avatars, facilitated by networked computers"[25]. EDUCAUSE, a non-profit association concerned with leveraging technology to improve higher education, defines a virtual world simply as an "online environment whose 'residents' are avatars representing individuals participating online."[26] Still, other definitions which address the specific affordances of this modality help us understand the potential of the technology as well. Examining popular virtual world applications can help frame an understanding of virtual worlds as "online 3-D virtual worlds …within which residents are able to establish identities (avatars), explore, create and communicate. [Further, a virtual world may] lend itself well to social networking, collaboration and learning."[27]

Avatars

The *Association of Virtual Worlds Blue Book* helps novices get started in virtual worlds by first explaining what an avatar is: "Avatar" comes from Hindu mythology and means the incarnation of a divine being. But in the virtual world, an avatar is an icon or representation of a user.[28]

In a virtual world, however, the avatar is also both a navigational and experiential tool. With the avatar being a representation of self, learners ascribe a personal connection that enables them to engage in the virtual space as an extension, alternative, or augmentation of the real world. Thus, we see the adherence to social norms and behaviors, such as observance of personal space, 'eye' contact, attention to appearance, emotions, gesturing, etc., typically seen in face-to-face interaction.

While the use of avatars in virtual worlds is the standard method of navigation and interaction, there is currently no standard definition of virtual worlds in general. Therefore, it is important to examine the commonalities among the available virtual world platforms to help frame a conceptual understanding of what virtual worlds offer beyond what our current instructional design toolkit provides.

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[25] Bell, M. (2008). Toward a definition of "virtual worlds." *Journal of Virtual Worlds Research*, *1*(1), 2-5.
[26] EDUCAUSE Learning Initiative. (2006, June). *7 things you should know about virtual worlds*. http://www.educause.edu/ELI/7ThingsYouShouldKnowAboutVirtu/156818
[27] Institute of Electrical and Electronics Engineers. (nd). *IEEE islands in Second Life*. http://www.ieee.org/web/volunteers/tab/secondlife/index.html
[28] Association of Virtual Worlds. (2008). *The blue book: A consumer guide to virtual worlds* (4th ed.). Retrieved from http://www.associationofvirtualworlds.com/pdf/Blue%20Book%204th%20Edition%20August%202008.pdf

The Evolution of the Virtual Worlds Industry

The concept of virtual worlds, as a collaborative learning tool, is not new. In fact, three-dimensional (3D) virtual worlds have been around since 1995, with one precursor, Multi User Domains (MUDs), dating back to 1978.[29] The pace of development began to accelerate in the mid-1990s on multiple fronts. Since 1995, there has been a series of new launches of virtual worlds, ranging from virtual world prototypes on through the first release of Second Life, currently the most used virtual world, in 2003. Second Life is used for many different purposes, including community-building and games, but also for business collaboration and for educational purposes.

Early on, the concept of virtual worlds was also explored in science fiction novels such as *The Three Stigmata of Palmer Eldritch* (1965), *Neuromancer* (1984), and *Snow Crash* (1992), and in popular films which led to film sequels and launching a mini-industry of movie-themed comics, video games, and animations as well. The launch of AlphaWorld (1995) signaled the beginning of a new era in virtual worlds by providing a web-based, collaborative virtual environment. Mega hits like EverQuest (1999) and World of Warcraft (2004) continued to popularize virtual worlds into mainstream entertainment vernacular and culture. The video game industry also began offering virtual world and role-playing games both for dedicated video game hardware, as well as for online play.

This is, by far, just a look in the past. With augmented reality, mixed reality, improved mobile technologies, and other emerging technologies, virtual worlds will continue to morph in years to come.

Affordances of Virtual Worlds

Virtual Worlds are graphically rich tools that support first-person, individual exploration and group collaboration. Given that one of the major complaints learners have about distributed or distance learning is a feeling of being disconnected from the other learners, virtual worlds address this challenge through the manner in which they enable synchronous and asynchronous learning. Specifically, virtual worlds facilitate a learner-centered approach wherein learners can determine when and how to navigate through the learning experience. Thus, learners may use virtual worlds to familiarize themselves with content; practice processes, procedures, demonstrations, and problem-solving and decision-making activities; conduct self-assessments and craft self-remediation approaches. Similarly, learners may also use virtual worlds to test their understanding of content by sharing their views with peers; negotiating meaning or understanding together with peer groups; examining the impact of others' interpretations in context, thereby supporting problem-identification.[30,31,32] Indeed, "problem finding is central to problem solving"[33] .

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[29] Jackson, P. (2007, March 23). The real business of virtual worlds: Firms creating new virtual worlds must balance real revenues with high risks. Cambridge, MA: Forrester Research.

[30] Chin, S. & Williams, J. (2006). A Theoretical Framework for Effective Online Course Design. Journal of Online Learning and Teaching. 2(1). Retrieved from http://jolt.merlot.org/05007.htm

[31] Merrill, D. (2007). A Task-Centered Instructional Strategy. Journal of Research on Technology in Education. 40 (1), 5-22.

These collaborative opportunities are but a few of the ways in which a learning experience in virtual worlds can exploit the strength of the tool. The salient point here is this: research shows that collaboration is a powerful instructional tactic (planned activities) and learning strategy (learner-initiated activity). Virtual worlds represent an optimal environment for collaboration or "collective problem resolution via mediated interaction" [36] because it enables both realistic contexts for learning and "representational" contexts for learning. In this sense, one can create a real-life environment that is only as fictional as to the degree which all risk is removed. The prime learning objectives and context remain, but the potential for loss, harm, discouragement are diminished or eliminated in order to facilitate more in-depth experiences, understanding, and awareness. The "representational" context, on the other hand, offers an opportunity to do what cannot otherwise be done. For instance, in no context other than a virtual world can an individual "walk through or become part of" a particle, data set, or organism. Certainly, in no other context could such an exploration accommodate a group of individuals. Further, in no other context could geographically dispersed individuals construct an object together in a tangible, graphically rich environment where the geographical dispersion is replaced by a sense of "there-ness" which creates a fluid interaction much like that experienced in real-life interface. Such interactions leave the learners with a perception of having "been someplace," "experienced something first-hand," and "connected with people."

Virtual worlds have the benefit of affording learners a place to go in order to experience some situation first-hand, as an individual, and with other people. While there are six affordances most virtual worlds have in common,[34] they all seem to converge in such a way that the most unique affordance becomes a reality. Figure 11 represents the conceptual framework that depicts how virtual worlds may enable experiences that are meaningful and successful.

Maximizing each of these inherent affordances may support a better learning experience. The *How People Learn* framework is a useful construct to consider when designing web-based learning opportunities.[35] According to the framework, there are four optimal learning conditions centered on the learner, knowledge, community, and assessment which must be taken into account in the design of a successful online learning environment. In Table 5, the affordances of virtual worlds are examined through the lens of Bransford's theories on how people learn. While some of the affordances supporting *Persistence* may not be exclusive to virtual worlds as a technology medium, the concept of persistence, as defined in this chapter, is unique to virtual worlds.

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[32] Jonassen, D. (2000). Toward a meta-theory of problem solving. Educational Technology: Research & Development. 48 (4), 63-85.

[33] Dede, C. (2007). Reinventing the role of information and communications technologies in education. *Yearbook of the National Society for the Study of Education*, *106,* 11 – 38.

[34] O'Driscoll, T. (2008, November 2). Co-creating the sensibilities. *Learning Matters!* Retrieved from http://wadatripp.wordpress.com/2008/11/02/co-creating-the-sensibilities

[35] Bransford, J., Brown, A., & Cocking, R. (1999). How people learn: Brain, mind experience and school. Retrieved on November 1, 2008, from http://cde.athabascau.ca/online_book/pdf/TPOL_chp02.pdf

Figure 11: Affordances of Virtual Worlds

- Co-existence—allows many users to participate simultaneously in a shared environment
- Graphical User Interface—offers visual depiction of and means of interaction with environment
- Presence—affords real-time interaction; direct and indirect interaction, synchronous and asynchronous interaction
- Co-creation—supports content development or modification
- Persistence—maintains 24/7 existence regardless of user login status; the presence and processing of synchronous and asynchronous interactions and contributions of all avatars and objects within the world.
- Collaboration—encourages development of in-world groups [Ibid36,37]

Table 5: How People Learn Framework & Affordances of Virtual Worlds

How People Learn Framework	Affordances of Virtual Worlds	Virtual World Design Considerations
LEARNER-CENTERED	Presence Coexistence	➢ Create individual and group activities ➢ Plan for synchronous and asynchronous interactions
KNOWLEDGE-CENTERED	Graphical User Interface Persistence	➢ Develop interactive objects beyond basic presentation slides and videos ➢ Make use of notes, basic building capabilities, and problem-identification activities ➢ Look for platforms that enable remote ways to stay connected to the world via communication/ interactions, file portability, asset ownership

[36] Virtual Worlds Review. (nd). What is a virtual world? Retrieved from http://www.virtualworldsreview.com/info/whatis.shtml

[37] Federation of American Scientists. (nd). *FAS virtual worlds whitepaper*. Retrieved from http://vworld.fas.org/wiki/FAS_Virtual_Worlds_Whitepaper

How People Learn Framework	Affordances of Virtual Worlds	Virtual World Design Considerations
COMMUNITY-CENTERED	Co-creation Collaboration	➢ Include activities and opportunities for multiple perspectives to converge ➢ Exploit tried and true instructional strategies that foster collaboration ➢ Reward collaboration
ASSESSMENT-CENTERED	Persistence Coexistence	➢ Use synchronous/asynchronous learning opportunities ➢ Capitalize on avatars, objects, and the environment's persistent nature

Virtual Worlds for Learning

Crafting meaningful learning experiences has, historically, been a great challenge in situations where context is as important as content. Role playing scenarios, case studies, and discussions are a few of the instructional strategies used to provide a rich, experiential aspect to traditional classroom and e-learning courses. These same strategies can still be used in a virtual world; however, these approaches now have the added benefit of a group dynamic in a persistent, graphically rich space that is real, rather than imagined; that is co-created rather than dictated; that is simultaneously shared by many for the purpose of collaboration, rather than accessible to a selected few. Leveraging the significant advances in technology which has yielded faster, cheaper, and more ubiquitous than even ten years ago, virtual worlds provide for new instructional strategies not possible in traditional learning environments. We can anticipate that virtual worlds are here to stay and to continue to grow as the technology continues to improve. Gartner, Inc., a leading research firm, identified IT for Green, Social Computing, and Advanced Analytics among the Top 10 Strategic Technologies for 2010, and virtual worlds enable these technologies to reach new dimensions through its unique affordances as a collaborative tool.[38] There is no shortage of hype and expectation regarding the Knowledge Revolution, but in the near future we can expect faster, better, cheaper, and more engaging versions of knowledge-sharing technologies, infrastructures, and protocols to emerge. Even more importantly, the technology will become convenient, easy, and reliable.[39] Indeed, in the years to come, virtual worlds will be among the top tools used to conduct business, participate in meetings and training events, and socialize.

[38] Gartner Inc. (2009, October 20) Press Release: Gartner Identifies the Top 10 Strategic Technologies for 2010. Retrieved from http://www.gartner.com/it/page.jsp?id=1210613

[39] Norris, D., J. Mason, and P. Lefrere. (2004) Experiencing knowledge. Innovate 1 (1). http://www.innovateonline.info/index.php?view=article&id=5

With more than 300 virtual world products on the market today targeting a number of different audiences, and with projections to increase exponentially in the next several years, it is becoming imperative for implementers to be aware of their own functional and technical requirements.[Ibid 31] Thus, instead of jumping on the virtual world bandwagon "for the cool factor" or "to keep up with the Jones's", a clear understanding of the features that most virtual worlds share helps decision-makers identify the unique attributes that may address specific training, education, or performance improvement needs, which will also aid in developing sound instructional design approaches. Understanding why one needs a virtual world, with specific goals, objectives, and functional requirements, will enable organizations to directly benefit from the unprecedented advances of today's virtual worlds, worlds that also provide a comprehensive forum for collaboration, reflection, and extended learning experiences.

CONCLUSION

Throughout this Guide, the focus of instructional media selection has been on the learning environment, and not the technology, as the primary factor 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:

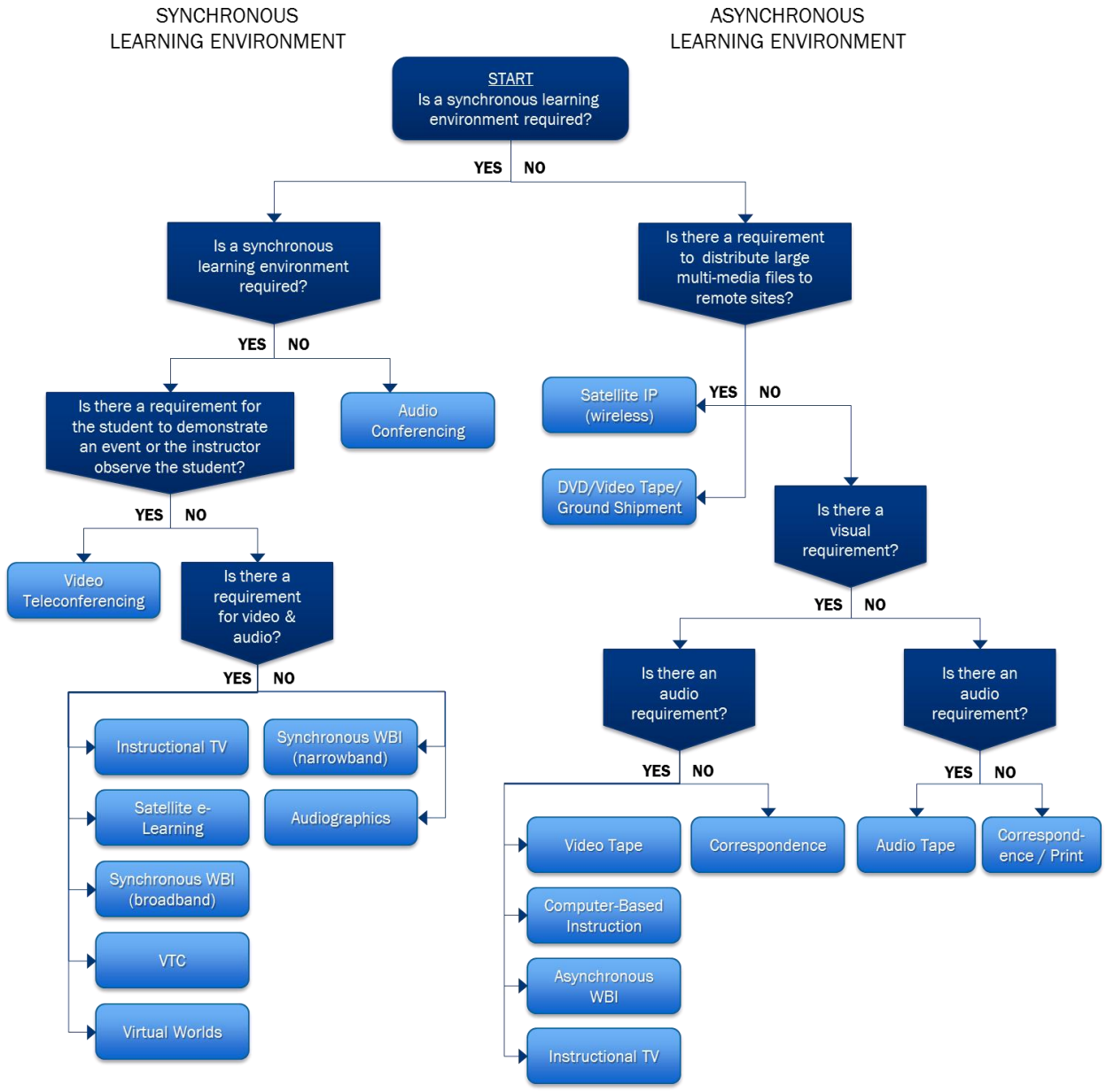
There is no single best model of distance learning. The quality and effectiveness of distance learning are determined by instructional design and technique, the selection of appropriate technologies, and the quality of interaction afforded to learners.[40]

The authors concur with the statement that, indeed, 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.

Finally, 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.

[40] U.S. Congress, Office of Technology Assessment. (1988). *Power On! New Tools for Teaching and Learning.* http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1d/9c/61.pdf

Figure 12: Distance Learning Instructional Media Selection Matrix



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 is an Associate Professor in the School of Education, American InterContinental University Online Master's of Education (MEd) 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. 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. And 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 20 years, Dr. Phil Westfall has been 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 355 receive sites (including Europe, Middle East, and the Pacific Rim) through a satellite uplink linking 18 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 Air University's Educational Logistics & Communications Division. 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 10 uplinks used by 17 government agencies reaching over 2,300 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 by Satellite, 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 Business Intelligence Board 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 Teleconferencing Magazine's Hall of Fame. He also received the FGDLA

Outstanding Distance Learning Network for the year 2000. He 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 Engineering Technology & Management.

Keysha I. Gamor, Ph.D.

Dr. Keysha I. Gamor is a Virtual & Immersive Worlds Consultant and formerly an Instructional Systems Designer (ISD) & Research Scientist for the Instructional Design Team at the Advanced Distributed Learning Initiative (ADL), Office of the Secretary of Defense. In that role, Dr. Gamor was responsible for developing ISD and standards guidelines for emerging technologies, such as Web 2.0 (social media), 3DI, serious games, mobile learning, Virtual Worlds, and Virtual Reality. Dr. Gamor's contributions support the ADL Initiative within the Department of Defense as well as other civilian organizations, academia, and industry on an international basis. Dr. Gamor also contributes to the development and refinement of the Sharable Content Object Reference Model (SCORM(R)) and to other activities in support of the continued expansion of the ADL Initiative.

Dr. Gamor has more than 15 years of experience in teaching, instructional design, web design, as well as research and development for education and training technologies. As an ISD, Dr. Gamor has examined assessment strategies in virtual learning environments. More recently, she has researched and piloted the use of social media in federal spaces.

Dr. Gamor began her professional career as a Professor of English Composition and Literature at Montgomery College, where she designed and piloted their distance learning program. She has performed ISD consultative services in the private sector, supporting civilian, military, and corporate clients. Dr. Gamor is recognized as a thought leader in her field and has served as a judge for several nationally recognized industry awards programs in gaming, courseware development, and immersive learning.

Dr. Gamor earned her Doctorate in Education with a concentration in Instructional Systems Design and Organizational Learning from George Mason University in Fairfax, VA. Her dissertation title reflects her main research area of interest (*Moving Virtuality into Reality: A Comparison Study of the Effectiveness of Traditional and Alternative Assessments of Learning in a Multisensory, Fully Immersive VR Physics Program*, May 2001). Dr. Gamor also holds master's degrees in Teaching Composition and Literature and in Professional Writing and Editing. She earned her B.A. in English from James Madison University, with a minor in Education.