Distance Learning Framework

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Introduction

Mention distance learning and everyone knows what you are talking about. Unfortunately, no one is talking about the same thing...

Distance learning is popular. As with many popular subjects, the term is used to describe a number of disparate activities and its definition has become the subject of hot debate. (There is, in fact, a web page dedicated solely to a list of definitions of distance education.)

To avoid excluding any constituents, this document does not attempt to define distance learning. Instead, it attempts to

- Describe and categorize the uses of distance learning
- Explain the relationship of tools and technologies to the key functions of distance learning
- Provide practical guidelines for selecting tools and methodologies based on the business and educational goals of your project

The document is divided into three sections:

- Background: briefly describes the development of distance learning, summarizing the advantages and limitations of current technology
- A Distance Learning Framework: presents a conceptual model for understanding the relationship between the educational and business goals and the technologies that support those goals
- Using Distance Learning: provides a practical guide for designers, developers, and instructors on selecting technologies and methodologies to meet their specific goals

The History of Distance Learning

Distance learning began in the late 1800's with correspondence courses and printed materials. From the beginning until today, it has been used primarily to provide learning opportunities to those who -- either due to geographic location or time limitations -- cannot participate in conventional on-site instructional programs.

Over the years, new communication technologies have been adopted for use in distance learning: first telephone, radio, and television, then computers and video tape, and most recently the Internet and various videoconferencing and streaming media technologies. In each case, the new technology provides some long sought-after capability. At the same time, it presents a challenge to the distance learning provider to evaluate it against existing tools and to develop its use so that it complements the other technologies that are needed to provide a complete solution.

Distance Learning Today

In the past five to ten years, the capabilities of distance learning have expanded exponentially. Largely due to the explosive growth of the World Wide Web and its accompanying technologies, providers of distance learning solutions now have a broad spectrum of techniques available to them.

Perhaps the two most significant advances are:

- Broad access to the Internet
- Low cost audio, video and two-way conferencing technologies via the World Wide Web

The rapid acceptance of the Internet by business and the general public provides an almost universal delivery mechanism for distance learning materials. Built on top of the Web as a basic delivery mechanism, new software-only media formats and applications provide alternative methods for delivering "live" events.

Another, somewhat less obvious but equally significant, transformation brought about by the World Wide Web is the elimination of "the platform problem". The predominance of Microsoft Windows as a platform, in conjunction with the availability of standard data formats and players such as HTML, Javascript, Java, Shockwave, QuickTime, and RealAudio, have eliminated many of the difficult decisions that had to be made just five years ago.

In the past, instructional designers choosing to utilize the latest technology were, as a result, seriously limiting the audience for their learning materials due to the cost and limited availability of the equipment necessary to playback the material. Audio and video tended to be reserved for "remote classrooms" connected by a private audio or video network. These classrooms are expensive to set up and manage and still require students to travel to the local conference center to participate. With the advent of consumer-priced videoconferencing products, it is possible for students to participate in a "live" or virtual class without leaving their house.

The Future of Distance Learning

Despite its many benefits, the World Wide Web still has a long way to go to become the ideal distance learning environment. As explosive as its growth has been, the Internet does not reach everyone. If your audience does not have access to the Internet, the many benefits of the World Wide Web are a moot point. Bandwidth and software limitations restrict current video playback to "postage stamp" sized windows and slow framerates, making it a crude replacement for television at best and impractical for the broadcast of detailed procedures. Finally, usable technologies for connecting large numbers of individuals simultaneously with video and audio simply do not exist today.

Steps are being taken to improve the situation in all of these areas. New compression algorithms improve video performance; faster modems and more efficient protocals (such as HTTP V1.1) reduce the pressure on bandwidth; while "chaining" and multicasting make the broadcasting of audio and video to large populations practical. But progress takes time and in some cases (such as multicasting that is dependent on network routers) requires significant changes to the underlining infrastructure.

For the time being, the World Wide World is a nascent, if very promising, addition to the suite of tools instructors and information providers can use to reach remote learners. Just as with the integration of video and telephone technology to achieve videoconferencing in the 1960's, and the integration of cable and phone lines in cable modems today, the most effective distance learning solution will often involve the working together of both new and established technologies. One of the goals of this document is to help explain what components are needed to make distance learning work.

A Distance Learning Framework

Distance learning is often categorized by the technology used to implement it (videoconferencing, simulation, CBT, and so on) or by the physical attributes that describe it (local vs. remote students, synchronous vs. asynchronous delivery, etc.). This is not surprising since technology and the physical proximity of the participants play a key role in determining the capability and effectiveness of distance education. However, looking at the technology first tends to distract us from the basic tenets of instructional design: understanding the goals and designing a set of actions and metrics to achieve those goals.

The way to correct the balance is to go back and evaluate distance learning on its educational goals rather than the mechanics of how it is delivered. Go back prior to the decision to broadcast a live event rather than develop computer-based training. Go back before a "virtual classroom" metaphor was chosen over correspondence school.

Early on, in the planning and development of a distance learning solution, the requirements, the analysis, and the resulting decisions are identical to those for any other educational delivery. Who is the target audience? What are the learning objectives? How does one ensure and validate success? The result of this planning is the choice of a **mode of instruction**. Roughly speaking, the mode of instruction defines who controls the learning experience, the learner or the instructor. It also defines whether testing or other verification is used and, if so, whether it is strictly for the learner's benefit or is a transitional gateway to other parts of the curriculum (including completion of the course).

It is after choosing a mode of instruction that the methods and tools for delivering the instruction should be selected and the distinction between distance learning and traditional classroom instruction begin.

The following pages present a framework for distance learning that separates the topic into two parts:

- The modes of instruction and how they relate to distance learning
- The key functions needed for each mode of instruction and the technologies that perform those functions

Categorizing the Uses of Distance Learning

There are four basic uses for distance learning: support, self-directed, monitored,and instructor-led. These four categories represent the primary modes of instruction from support, where the subject matter and success of the training is defined entirely by the learner, to instructor-led, where the content, pace, and completion is controlled by the instructor.

The following table describes the four modes of instruction in more detail.

Support

Although it is not always considered a type of learning, support is one of the most critical learning activities in corporate environments. The role of support is to answer questions from the user or learner.

The learning event, as such, is completely driven by the user: he or she decides what question to ask and when it has been answered sufficiently. Time is often a critical factor, since the answer may be required to complete work that is in progress.

The role of the information provider is to determine what type of questions will be asked and provide brief, technically complete answers. Since predetermining what questions will be asked is often difficult, an alternate approach is to build a support "database" over time using actual questions that are asked and their answers. One example of such a system is the STARS database. Less formal systems include Notes conferences, online forums, and newsgroups that rely on other users to provide the answers; and FAQs and list servers that utilize the collected wisdom of

experts.

Self-Directed

Self-directed training (also known as "self-paced instruction") is similar to support in that the learning event is under the learner's control. The pace, the overall topic, and sometimes the sequence of instruction is chosen by the learner. The key differences are the breadth of the content and the motivation of the learner.

In support, the learner is looking to answer a specific question immediately. In self-directed training, the learner has chosen a topic to study and is willing to invest the time and energy towards its use at some future time. The learner is also willing to let the information provider define the level of content and encourage or require specific paths through the curriculm.

Self-directed training can involve interactive content, including animation, simulations, and testing. However the interaction is for the benefit of the learner and does not go beyond interaction between the learner and the training content.

Monitored

Monitored training is similar to self-directed except that aspects of the training are monitored by an intructor or facilitator. The monitoring can be as simple as recording who takes a course or as complex as authorizing and authenticating access to the content and validating completion of individual modules (through testing) before letting the learner proceed to the next topic.

The purpose of monitored training is to not only provide access to educational materials but to verify the effectiveness of the training and to encourage (and optionally reward) completion of recommended "tracks."

Monitored training is particularly useful for training and assessing disperse groups.

Instructor-Led

Instructor-led training comes closest to reproducing the traditional classroom experience. In fact, much instructor-led distance learning is modeled directly from college classrooms, including live broadcasts of the instructor, instructor-student conferences, tests, grading, and bulletin boards for communication between students (to give them the "you are there" feel).

The training does not necessarily have to be "synchronous" (that is, the instructor and learner do not need to communicate in realtime and individual students can progress at their own rate, if that is appropriate). However, there is an instructor or facilitator who monitors and administers the progress of each student.

Instructor-led training is well-suited for certificate and degree programs (where the performance of the learner must be validated) or where students can benefit from working with other remote learners.

For each mode of instruction, there are a set of functions that need to be performed (and corresponding technologies that are used to support those functions). The three primary functions are:

- Delivery
- Communication
- Administration

Each mode of instruction places different emphasis on the functions. The following chart illustrates the relative importance of each function to the different uses of distance learning.

Mode of Instruction	Function		
	Delivery	Communication	Administration
Support	■		
Self-Directed	■	■	
Monitored	■	■	■
Instructor-Led	■	■	■

Legend

■	Critical function to support this mode of instruction
■	Optional function that can be useful for this mode of instruction (based on business requirements)
	Not important

Understanding the Technology Involved in Distance Learning

Distance learning technologies can be categorized into the same three groups as the function they support: delivery, communication, and administration.

One of the difficulties of evaluating distance learning technologies is that different technologies perform different functions. To further complicate matters, certain technologies (such as videoconferencing) can be used for either one of two different functions, or both simultaneously. As a result, it is very important to recognize what the function is for which you are evaluating the technology before you compare it to other possible alternatives.

By classifying the technologies according to the operational functions they perform (rather than the media they handle or the technical features they advertise), it is possible to make a direct correlation between the mode of instruction and the types of technology that will be required. At the same time, each category can be further subdivided to provide a more detailed analysis of how accurately they match the requirements of a particular training program.

The following table describes the three categories of distance learning technologies in more detail.

Delivery

Delivery technologies are what are traditionally thought of as "authoring tools" or media. They deliver instructional content to the learner.

Delivery technologies can be as simple as printed books for text and graphics or as complex as multimedia presentations incorporating audio, video, and interactive simulations.

Within delivery, individual technologies are distinguished primarily by the type of content they can carry. A secondary distinguishing feature for media technologies (that is, audio and video) is whether they are "synchronous" or "asynchronous".

Communication

Communications technologies allow the learner and the instructor (or the learner and other learners) to exchange information.

Communication technologies range from traditional mail to multi-party realtime videoconferencing.

As with delivery technologies, one of the key characteristics for distinguishing different communication technologies is the content of the message: text, voice, or video. However, an equally important characteristic is **who** the learner can communicate with (whether just the instructor or with other students).

Administration

Administrative technologies cover a broad array of functions that manage use of the instructional content. Administrative functions include managing students (including registration, authorization, authentication, and billing), monitoring process through the material (such as logging and testing), and controlling

The key distinguishing features of administrative technologies are **what** is being managed and how much control is being exerted. For example,

It is important to note that many of the delivery and communication technologies have their own proprietary administration functions builtin. This fact, plus the need for many administrative functions to be integrated with the delivery technology, result in there being very few standalone administrative technologies available beyond the traditional manual processes.

What distinguishes individual technologies within each category will differ from function to function. However, in each case the driving factors behind the segmentation and selection of specific tools are the business or educational goals:

- The selection of a delivery technology is driven by the instructional content and the ability of the technology to effectively present that content
- The selection of a communication technology is driven by the mode of instruction and the type, frequency, and immediacy of communication between the learner and the instructor or other learners
- The selection of an administrative technology is driven by the business requirements to restrict, monitor, and verify completion of the instruction

The section on Using Distance Learning goes into more detail about how to select distance learning technologies. The following table summarizes the distinguishing features within each category.

Delivery	Communication	Administration
Distinguished by the content they are able to carry: ● Text and graphics ● Audio ● Video ● Multimedia ● Synchronous vs. asynchronous ● Simulations	Distinguished by the mode of communication they support: ● One-to-One ● One-to-Many ● Many-to-Many ● Unidirectional or bidirectional ● Media (text, audio, video) ● Synchronous vs. asynchronous	Distinguished by the level of monitoring and verification required by the business goals: ● Registration ● Authorization and authentication ● Logging ● Testing ● Certifying

Catalog of Distance Learning Tools and Technologies

Having established a taxonomy for distance learning technologies, it is possible to "fill in" the matrix with real world examples. The following table uses the three categories to position many of the most commonly used distance learning tools and technologies, including both the tradional manual technologies (such as paper, mail, and telephone) and the more recent web-enabled techniques. Some important points to note are:

- Despite their age, the traditional techniques for delivering distance learning (paper and television) still have significant benefits over the more recent additions.
- Most videoconferencing technology can be used for either (or both) delivery and communication.
- All-in-One solutions have the advantage of providing the integration desired in monitored and instructor-led training between the delivery and the administration. However, the cost is that the instructional designer is restricted to the tools provided by the solution when other technologies might be more effective for delivery and communication.

<table>
<tr><th>Delivery</th><th>Communication</th><th>Administration</th></tr>
<tr><td>Traditional

Paper</td><td>Traditional

Mail
Telephone</td><td>Traditional

Mail
Telephone</td></tr>
<tr><td>CBT Authoring Tools

IconAuthor
Jamba
Multimedia Toolbook
Director
AuthorWare</td><td rowspan="2">Text

Notes
Forums
Newsgroups
E-mail Chat</td><td rowspan="3">Administrative Frameworks

Merlin</td></tr>
<tr><td>Simulation and Shared Screen

Netmeeting
Itinerary</td></tr>
<tr><td>Audio and Video Broadcasting

Television
Radio
Realaudio
RealVideo
VDOLive
VXstream</td><td>Voice

Teleconference
Internet Telephony</td></tr>
<tr><td colspan="2">Video Conferencing

Picturetel
CU-Seeme
Private Video Networks</td></tr>
<tr><td colspan="3">All-in-One Solutions

Symposium</td></tr>
</table>

Note

The preceding table is not intended to be comprehensive. The goal is to provide a realistic demonstration of how specific technologies can be positioned and compared. If you have any suggestions for other technologies to include, please contact Andrew Gent.

Using Distance Learning

The distance learning framework characterizes the uses of distance learning and explains the relationship between distance learning technologies and the educational functions they support. What the framework does not do is provide advice on why to choose one technology over another or how to integrate several technologies into a complete solution.

In theory, it is possible to define clear rules for making such decisions, based on a prioritized list of requirements and environmental variables. Unfortunately, reality is not so perfect. Most real-world decisions are based on fuzzy requirements, personal experience, difficult tradeoffs, and educated guesses.

The following sections provide some practical suggestions for deciding when to use distance learning, how to incorporate it into a curriculum, and how to establish the necessary infrastructure to make the distance learning experience successful.

Determining When and How to Use Distance Learning

The most common reasons for choosing a distance learning solution are:

- Location: a geographically-dispersed audience physically cannot attend on-site training
- Time: students do not have sufficient blocks of time to dedicate to traditional training events
- Cost: the cost of instructors, facilities, and set up (particularly for lecture labs) exceeds the financial capability of the sponsoring organization
- All of the above

Where location or time for travel is the limitation, replicating the classroom online (in a "virtual classroom") is very appealing, especially if the course is also taught in a traditional setting and, as a result, there is no additional cost for the content. This form of instructor-led distance learning is common where traditional courses existed.

When time is the primary issue, classrooms -- whether physically on-site or provided virtually through distance learning -- do not address the core problem. An alternate mode of instruction is needed that allows the learner to take instruction in bits and pieces or as time permits. This can be self-directed instruction, monitored, or asynchronous instructor-led instruction where the facilitator plays the role of tutor rather than instructor.

When cost is the primary issue, the choice of a mode of instruction becomes a business decision rather than an educational one. The instructional designer must decide how to tradeoff capabilities and still maximize the accessibility and effectiveness of the training given the financial restrictions.

Perhaps the most common reason for using distance learning is a combination of all three factors: location, time, and money. Some of the audience cannot physically attend, some do not have the time, and there are insufficient funds to address each audience segment in the way that suits them best. In these situations, the designer must choose a "second best" approach, making tradeoffs between effectiveness and coverage, based on their understanding of the business goals.

The decision to utilize distance learning is usually made as part of the definition and design of a new program or in an attempt to fix an apparent lack or failure in a existing program. For new programs, the main objective should be to understand the requirements and environmental limitations as thoroughly as possible in order to select the best mode of instruction. For existing programs, the major danger is the assumption that existing content can simply be "put online" to expand or enhance the reach or effectiveness of the program.

The effectiveness of training events is the result of many subtle and not so subtle ingredients. For example, the ability of an instructor to see the students' faces, gauge their reaction to the material, and adjust the lesson accordingly is one of the benefits of in-person training. Placing the instructor in front of a camera and broadcasting the seminar to remote locations may successfully transmit the physical event, but loses one of the the key interactions between student and instructor. Similarly, being in the room and being able to listen to the instructor and review what he or she has written on

the board helps maintain attention and further comprehension. Remote participants do not have this luxury if they cannot control what the camera is showing.

Distance learning is not just transmitting existing instructional content across other media. It requires a conscious change or adjustment in the way instruction is provided. Otherwise, it may be better to consider using an alternate mode of instruction for the distance learning component. One example of changing modes of instruction is to use video tape rather than live broadcasts, so remote learners can control the pace themselves as a replacement for the adjustments normally made by the instructor.

Choosing the Appropriate Technology for the Business Need

In an ideal world, the instructional designer chooses a mode of instruction based on the project requirements before choosing the technologies for delivery, communication, and administration (as needed). Having chosen a mode of instruction, it is possible to evaluate each function (delivery, communication, and administration) separately and determine what characteristics are needed and what technology best suits those needs.

In reality, the choice of a mode of instruction and the choice of technologies are often bound together. This is partially a result of the educational priorities for programs not always being clear, but it is also due to the limitations of many of the current technologies. Say, for example, the preferable mode of instruction for a program is monitored self-paced instruction, where the monitoring consists of verifying that the learner has completed all of the modules at one level before moving on to a new topic. On examining the technology, however, the content (detailed mechanical procedures) calls for high-quality video. To get the level of detail necessary, the video is too big to work with streaming media, such as RealVideo or VDOLive. The video could be put on VHS tapes or packaged as a CBT on CDROM, but then there is no automatic mechanism for monitoring if the material is actually viewed. At this point, the instructional designer must make a tradeoff between performing the desired monitoring and going to unmonitored self-directed instruction or changing the content so delivery and monitoring are easier.

What happens, in the best circumstances, is that there is an iterative design cycle where different modes of instruction are tested against the technologies that are needed to support the desired content and functions. This design cycle can occur on paper before development begins, given the right level of technical background on the technologies.

Designing a Learning Environment to Support Distance Learning

One aspect of distance learning programs that has been mentioned in passing but deserves further discussion is understanding what infrastructure exists and what needs to be developed. This question affects all three functions: delivery, communication, and administration and must be addressed during the design phase since it will affect all aspects of the program, including the selection of technologies and the mode of instruction.

The World Wide Web, for example, is an extremely cost effective and feature-rich technology for delivering distance learning. However, it is only cost effective if ubiquitous Internet access already exists in the target audience. The cost benefits are quickly eliminated if you must first establish an Intranet from scratch.

Another example is the use of private video networks. Setting up a private video network (such as DVN) is extremely expensive if you are delivering only a few courses a year. However, if a private network already exists and is available for your use, live broadcasts on a private network could be both significantly more effective and more cost efficient than other options.

Finally, one of the ongoing issues in the design of distance learning environments is the limited support for administrative functions. There are very few technologies that support administration (registration, authorization, logging, testing, certification, and so on) in an integrated way. This is largely due to the interdependency between the administration function and the delivery function.

As a result, distance learning environments tend to take one of three approaches to administration:

- Manual Administration: Since there is no standard administration technology, a number of systems perform registration and certification by the traditional methods of phone or mail. Usernames and passwords are used for authorization purposes and paper tests are used to test and certify completion of the course.
- Rudimentary Administration: where administration functions are automated, they tend to be at a fairly high level to avoid having to integrate with the delivery technology. For example, MOLI and MENTYS use self-contained training modules and the administrative functions

handle these modules as black boxes. This technique is common for self-directed instructional materials.

- Do-it-Yourself Administration: where any further level of complexity is required in the administrative function, it is necessary to develop custom administrative applications. This is possible, but requires programming skills that are not always core to training organizations.

New products, such as Symposium from Centra Software, are coming to market that provide more complete administrative support in an integrated package. However, use of such "out of the box" solutions usually means that you must also use their technologies for delivery and communication, in which case you are trading optimal solutions for delivery and communication in favor of completeness of the administrative function.

Conclusion

In conclusion, there are a number of factors that you should consider when designing a distance learning solution:

1. Understand the needs of the audience

Make sure you understand what issues make other training options, such as on-site training, inappropriate for the audience so that the mode of instruction you choose effectively addresses these needs.

2. Understand the educational goals

Write down the educational goals and identify any requirements for monitoring, testing, and validation. These requirements will impact your selection of both delivery and administration technologies.

3. Determine if there is any existing infrastructure that can be used

Any solution will be prohibitively expensive if there is no infrastructure to rely on. Determine if the audience has access to broadcast media (radio and television), the Internet, or local videoconferencing stations.

4. Select a mode of instruction and the appropriate technologies to support it

Based on what you learn from steps 1 through 3, select a mode of instruction and corresponding technologies for all of the required functions. Be prepared to iteratively choose and test your design several times before you are satisfied. Also, be sure you have clearly defined the requirements for administrative functions because they will strongly impact your delivery strategy.

6. Evaluate technologies for each of the major functions separately

Several technologies, video and audio conferencing in particular, can perform more than one function in distance learning. However, using one techology to perform multiple roles does not always provide the savings one might assume and frequently results in neither function being performed to its fullest. For example, if you wish to broadcast live video to a large number of sites, videoconferencing technologies such as CU-Seeme are a good option. If you also want the remote sites to be able to ask questions, CU-Seeme provides that capability. However, two-way videoconferencing on the web has serious technical limitations as the number of participants increases. Rather than using CU-Seeme for both delivery and communication, a better solution is to select a communications technology that scales well and is focused on bidirectional audio connections, such as teleconferencing by phone.

5. Do not assume new technologies are better

The advent of software-only playback and streaming video has had a significant impact on distance learning. It is now possible to distribute video on-demand at very low costs and integrate it with other content. However, do not confuse the clear advantages of such technology with its overall performance as an educational medium. The quality of the image, sound, and frame rate cannot compare to the equally cheap technology of VHS tapes. Tapes are also more readily usable by the public at large. Therefore, be sure to compare any technologies against the goals of

the content and the capabilities of the target audience before making a choice.

The key is to always give priority to the educational and business goals. Do not get caught up in evaluating the capabilities and limitations of the tools and, as a result, let technology drive the instructional strategy. The effectiveness of the instruction and success of the learner must come first.

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