Chapter 4

INSTRUCTIONAL TECHNOLOGIES – ANALYSIS AND SELECTION CRITERIA

Overview

Purpose

This chapter presents a standard set of criteria that can be applied to any instructional medium to evaluate the relative effectiveness of the medium. It then applies the criteria to each instructional medium presented to determine the advantages and disadvantages resulting from its use. The chapter concludes with a presentation of a process for selecting instructional media when migrating existing resident instruction to an instructional technology or distance learning format.

Where to Read About It

This chapter contains six sections:

Continued on the next page

Overview (continued)

References The material in this chapter is based on the following references:

- MIL-PRF-29612, *Training Data Products*
- MIL-HDBK-29612-1, *Department of Defense Handbook, Guide for Acquisition of Training Data Products and Services*
- MIL-HDBK-29612-2, *Department of Defense Handbook, Instructional Systems Development/Systems Approach to Training and Education*
- MIL-HDBK-29612-3, *Department of Defense Handbook, Development of Interactive Multimedia Instruction (IMI)*
- MIL-HDBK-29612-4, *Department of Defense Handbook, Glossary of Training Terms*
- *Distance Learning Curriculum Analysis and Media Selection,* Air University, Maxwell AFB, AL, 4 Feb 1994
- AF Handbook 36-2235, *Information for Designers of Instructional Systems, Volume 4*
- AF Manual 36-2234, *Instructional Systems Development*
- AFDLO Home Page web site: *http://www.au.af.mil/afdlo*
- Air Force Publications and Forms: *http://AFPUBS.HQ.AF.MIL/*
- American Distance Education Consortium: *http://www.adec.edu/*
- Best Practices in Distance Learning: *http://snow.utoronto.ca/best/distance.html*
- Distance Education at a Glance: *http://www.uidaho.edu/evo/distglan.html*
- Distance Education Primer: *http://www.teletrain.com/Primer.html*
- Educational Resources Information Center: *http://www.aspensys.com/eric/*
- US Distance Learning Association: *http://www.usdla.org/*
- WWW Virtual Library - Distance Education: *http://www.cisnet.com/~cattales/Dedication.html*
- Federal Government Distance Learning Association: *http://www.fgdla.org/index.htm*

Section A

Media Feasibility Assessment

Feasibility Criteria

The instructional design characteristics identified in the following table can be applied to each type of instructional technology to gauge the appropriateness of the various media. These characteristics can be applied to the use of technology to support resident courses as well as distance learning initiatives. The following criteria are used in this section to compare and contrast the media alternatives.

Development Effort	The time, effort, and/or resources required to plan, design, develop, implement, and evaluate the instruction.
Convenience of Instruction	The extent to which the participant is allowed to control or determine the time, place, pace, or duration of instruction, and/or accessibility of the instruction
Student Motivation	The ability of the instructional system/media to motivate and/or involve the student when used as the primary vehicle for instruction.
Equipment and/or Support Requirements	The degree to which special equipment or other support systems are required for delivery of the instruction.
Instructor Requirements	The degree to which instructor involvement is required during delivery of the instruction to employ the medium effectively.
Level of Interactivity	The potential level of engaged response/interaction between the student and the medium provided or supported by the medium.
Feedback Capability	The type and nature of student feedback supported by the instructional medium.
Ease of Revision	The complexity of revising or updating the medium to accommodate changes in course content.
Ease of Use	Comfort of the instructor and the student with the medium; degree to which time must be spent familiarizing users with the technology.
Versatility	The ability of the medium to support instruction and/or supplement other technologies.

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Media Feasibility Assessment (continued)

Potential Applications

Each medium is examined in terms of its potential applications – when it is most appropriate to use the given medium to support instruction. In those cases where there are conditions under which the given media would not be effective, the conditions are noted.

Cost/Benefit Considerations

Cost/benefit analysis is being used with increasing frequency to help define whether a proposed approach to instruction is worth the projected costs. Later in this chapter, the user will find detailed discussion on cost models and processes. In this section, the relative costs and benefits of each medium are discussed. In addition, the estimated compression rate and development ratios are identified.

Compression Rate: Presented as a percentage, the compression rate is the figure used to estimate the number of hours of instruction required to conduct an existing resident course if converted to the given technology.

For example – The estimated compression rate for courses converted to ICW is 35%. That is, the course duration for a resident course would be reduced by 35% if converted to ICW. If you are converting a 40-hour resident course to ICW, you would use the following formula to compute instructional hours:

40 hrs. resident instruction x 35% compression rate =
14 hours reduction
40 hrs. – 14 hrs. = 26 hrs. ICW

Thus, a 40-hour traditional course can be expected to be accomplished in 26 hours of instruction if the course is converted to ICW format.

Development Hours: Presented as three ratios indicating the number of man-hours per hour of instruction for an IT program of low/moderate/high complexity.

For example – The factors for ICW are estimated at 50/265/700 man-hours of development per hour of compressed instruction. Therefore, if a 26-hour course of low complexity is being developed, you would use the following formula to calculate development hours:

26 hours compressed instruction x
50 hours development per hour of instruction =
1,300 man-hours of development time

If it is a complex course, it may take an estimated 18,200 hours for development.

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Media Feasibility Assessment (continued)

Cost/Benefit Considerations (continued)

A word of caution: The compression rates and development hours are estimates only—they are based on Air Force and industry experience. The development times are based on the time it takes education and training personnel—the IT development team—to complete the ISD process and field ***new*** instruction. It does not take into account the task analysis process that is conducted by a career field nor does it take into account the ongoing operational evaluation or life cycle management of a course of instruction. The development times do not account for man-hours provided at remote sites in support of DL programs.

The low-end estimates assume a best case scenario with a simple topic and experienced personnel with good knowledge of content and tools. The high-end estimates imply that the topic is abstract or complex and developers have limited knowledge of the content and lack experience with development tools. The middle number represents the most likely estimate based on Air Force experience.

The more technically sophisticated the medium, the greater the need for highly skilled instructional designers and technologists. So it is not only the complexity of the course material that must be accommodated, but also the availability of a skilled development team.

The use of templates and other tools can reduce development time. The need to coordinate and share scarce resources can increase development time. It is the responsibility of the IT team to define, document, and factor in all of the quantitative and qualitative costs and benefits associated with a given instructional alternative so that each alternative can be fairly evaluated and the optimum solution selected on the basis of solid, well-documented analysis.

Section B

Application of the Criteria to the Media

Purpose

This section applies the criteria to each of the instructional technologies. The table presents the criteria, describes the medium's major strengths and weaknesses against those criteria, and provides an overall assessment of the effectiveness of the medium. Some potential applications of the medium and the cost/benefit considerations for each medium follow the table.

Criteria Applied to Print Medium

The following table applies the criteria to the use of print as the primary instructional medium.

Criteria	Application to Print	Effectiveness
Developmental Effort	The effort required varies depending on the scope and content of the print materials. Professional authoring of complete instructional print documents, manuals, or textbooks requires significant time and effort to research, design, develop, edit, and publish effective instruction. Available desktop publishing software has made it much easier to develop professional-looking print materials in-house.	-/+
Convenience of Instruction	Students can study at their own pace and review information as required.	+
Student Motivation	Requires higher level of student motivation for effective learning to take place. Student learning is dependent on reading ability. Lack of reading skills significantly impacts effectiveness of instruction.	-
Equipment/Support Requirements	Requires no special equipment or support.	+
Instructor Requirements	Minimum supervision, participation, or communication required.	+
Level of Interactivity	Passive in nature - low level of student interactivity.	-
Feedback Capability	Low level of feedback and reinforcement.	-
Ease of Revision	While easier to revise than most other media, revisions will require some time, resources, and effort to accomplish. Revised materials must also be reproduced and distributed to all applicable sites.	-
Ease of Use	Print is the most familiar of media. Instructors and students are comfortable using it.	+
Versatility	Handouts, outlines, booklets, brochures, ready reference guides can supplement other technologies/media.	+

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Criteria Applied to Print Medium (continued)

Potential Applications

Consider using print when:

- The task to be taught follows a set procedure and steps are easy to follow.
- Written materials are required for later reference.
- Self-study is an option.
- Ease of use is crucial.
- Equipment limitations exist.
- Close supervision and interaction are either not required or not available.
- When dollars are limited.

Print Cost/Benefit Considerations

Considerations: Print materials are relatively inexpensive to produce compared with other media such as satellite/computer-based instruction. Cost considerations include:

- Number of requirements (student/trainee throughput).
- Student location and distribution requirements.
- Complexity of the required instruction and format (color graphics, drawings, diagrams, photographs, etc., will generally consume more time and resources).
- Projected content changes and revision requirements.

Compression rate: It is estimated that a distance learning print-based course (e.g., a correspondence course) will reduce the instructional time required to cover the same material in a resident course by 25%.

Estimated development time: Use the following development estimates (per hour of compressed instruction) (includes editing):

Low Complexity	Moderate Complexity	High Complexity
15 hours	100 hours	250 hours

Criteria Applied to Videotape

Videotape-based training presents information to the student through visual and auditory sensory channels. The more varied the means of delivery, the more effective the communication. Instructional video builds on the old cliché that "a picture is worth a thousand words." The following table applies the criteria to the use of videotape as the primary instructional medium.

Criteria	Application to Videotape	Effectiveness
Developmental Effort	Professional quality, effective video instruction requires complex planning and a significant amount of time and effort to produce.	-
Convenience of Instruction	Students can study and review information at their own pace.	+
Student Motivation	Requires a higher level of student motivation for effective learning to take place.	-
Equipment/ Support Requirements	Videotapes are highly transportable and can reach many students. A videocassette recorder is required and is readily accessible.	+
Instructor Requirements	Little instructor supervision, participation, or communication.	+
Level of Interactivity	Passive in nature - low level of student interactivity.	-
Feedback Capability	Low level of feedback and reinforcement.	-
Ease of Revision	Course content needs to be stable since revisions normally require complete reproduction/ redevelopment of the taped instruction. Tapes must also be duplicated and distributed to all sites.	-
Ease of Use	Videotape technology is familiar to instructors and students, and they are comfortable using it.	+
Versatility	Videotapes can provide effective instructional support for other types of instruction. Also, videotapes can be retained for future reference.	+

Potential Applications

Consider using instructional videotapes when:

- Audio/visual presentations are important for clarity.
- Visual realism is necessary to accomplish learning objectives.
- Self-paced instruction or independent study is an option.
- Content is stable (no changes for at least a year).
- Interaction with or observation of performance by, an instructor is not required.

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Criteria Applied to Videotape (continued)

Videotape Cost/Benefit Considerations

Video production can be expensive, time consuming, and technically demanding depending on how it will be produced (i.e., an in-house effort or professionally produced).

Compression rate: It is estimated that a distance learning videotape-based course will reduce the instructional time required to cover the same material in a resident course by 30%.

Estimated development time: Use the following development estimates (per hour of compressed instruction) (includes production):

Low Complexity	Moderate Complexity	High Complexity
50 hours	175 hours	500 hours

Criteria Applied to Audiotapes

Audiotapes are used much like print, but instead of reading the content, the student listens to it using a tape player. Audiotapes can be used effectively for student learning, especially when combined with other instructional media. The following table applies the criteria to the use of audiotapes as the primary instructional medium.

Criteria	Application to Audiotapes	Effectiveness
Developmental Effort	Requires less time and effort than most other instructional methods. Similar to print.	+
Convenience of Instruction	Students can study and review information at their own pace.	+
Student Motivation	Requires a higher level of student self-motivation for effective learning to take place. Student learning is dependent on listening ability. Lack of auditory skills significantly impacts the effectiveness of the instruction.	-
Equipment/Support Requirements	Audiotapes are highly transportable and can reach many students. A cassette tape player is the only equipment required, and is widely available.	+
Instructor Requirements	Little instructor supervision, participation, or communication.	+
Level of Interactivity	Passive in nature - low level of student interactivity.	-
Feedback Capability	Low level of feedback and reinforcement.	-
Ease of Revision	Course content needs to be stable. Revisions require re-taping, duplicating tapes, and distribution to all sites.	-
Ease of Use	Audiotape technology is familiar to instructors and students, and they are comfortable using it.	+
Versatility	Audiotapes can provide effective instructional support for other types of instruction. Also, audiotapes can be retained for future reference.	+

Potential Applications

Consider using instructional audiotapes when:

- Visual and textual representations are not required, but verbal. communication and explanation will contribute to content clarity.
- Transmission of verbal cues and sounds are required.
- Self-study is an option.

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Criteria Applied to Audiotape (continued)

Audiotape Cost/Benefit Considerations

Audiotape development requires careful scripting; talent must often be hired for the final narration.

Compression rate: It is estimated that a distance learning audiotape-based course will reduce the instructional time required to cover the same material in a resident course by 25%.

Estimated development time: Use the following development estimates (per hour of compressed instruction) (includes production):

Low Complexity	Moderate Complexity	High Complexity
20 hours	80 hours	200 hours

Criteria Applied to Audioconferencing

Audioconferencing can be accomplished with off-the-shelf speakerphones. In order to connect numerous locations, however, additional equipment may be required. Audioconferencing can be an effective means of providing students access to experts. The following table applies the criteria to the use of audioconferencing as the primary instructional medium.

Criteria	Application to Audioconferencing	Effectiveness
Developmental Effort	Requires advanced planning to provide handouts with agenda/discussion topics, prerequisite assignments, etc. The easiest conference to set up on short notice.	+
Convenience of Instruction	Nearly everyone has access to a telephone and participants can connect from almost any location. However, requires all to meet/connect at a specific time.	+/-
Student Motivation	Provides real-time communications, collaboration, and interaction.	+
Equipment/Support Requirements	Other than a telephone, or speakerphone for larger groups, no special equipment is required. Most, if not all, telephone systems provide multi-site audio bridging. Existing SRUs can also be used for audioconferencing.	+
Instructor Requirements	In addition to instructing, the instructor must also facilitate, moderate, and manage student discussions and interactions.	-
Level of Interactivity	Allows everyone to participate and interact. Although large numbers can participate, it is generally more effective if the numbers are limited to ensure interaction.	+
Feedback Capability	Provides immediate verbal feedback. However, it can be a barrier for learners who process information visually.	+/-
Ease of Revision	The real-time nature of the instruction allows for instantaneous changes and revisions as required.	+
Ease of Use	Telephone technology is familiar to instructors and students, and they are comfortable using it. No equipment training required.	+
Versatility	Can be used in conjunction with, and provide effective instructional support for, other types of instruction. Conferences can be taped and retained for future reference or review.	+

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Criteria Applied to Audioconferencing (continued)

Potential Applications

Consider using instructional audioconferencing when:

- Student feedback and remediation are required.
- Site visits with subject matter experts cannot be arranged.
- Short courses/Tutorial type lessons are used.
- "Live" or synchronous communication is needed.
- Interviews/group discussion is required.
- Used in conjunction with other media.
- Student-instructor and student-student interaction is required.

Audioconferencing is not appropriate for training tasks that require development and/or application of psychomotor skills.

Audioconferencing Cost/Benefit Considerations

There are many compelling reasons to use interactive audioconferencing. They include the following:

Cost	One of the least expensive technologies.
Accessibility	Nearly everyone has access to a telephone.
Interactivity	Allows everyone to participate.
Convenience	Can connect to a conference from any location.
Spontaneity	Provides instantaneous communications and feedback.
Well-established	Has been used effectively for years.
Easy to use	No equipment training required!
Recordable	Can be taped for future reference.
Versatility	Can be used with other instructional technologies.
Scaleability	Can talk to one site or many sites.

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Criteria Applied to Audioconferencing (continued)

Limitations

There are relatively few drawbacks to using interactive audioconferencing. Most can be addressed in the design process. Limitations include the following:

- ***Is synchronous.*** Forces learners to meet at a specific date and time
- ***No visual feedback.*** Can be a barrier for learners that process information visually; also requires more concentration
- ***Can be impersonal.*** Can make some participants feel isolated since they can't see non verbal cues or body language
- ***Requires advance planning.*** Must be planned in advance to provide any handouts; thus, difficult to establish a conference on short notice
- ***Limited number of students.*** While it can be connected to hundreds, is more effective if size is limited to ensure there is interaction
- ***Potential equipment costs.*** Potential additional costs to consider include devices that may be required for larger groups, such as speaker phones, microphones, or response units, and an audio bridge to interconnect multiple phone lines and control noise.

Compression rate: It is estimated that a distance learning audioconference-based course will reduce the instructional time required to cover the same material in a resident course by 25%.

Estimated development time: Use the following development estimates (per hour of compressed instruction) (includes production):

Low Complexity	Moderate Complexity	High Complexity
10 hours	40 hours	80 hours

Computer-Mediated Communications

Computer-Mediated Communications comprises audiographics and computer mediated conferencing.

Audiographics

Criteria Applied to Audiographics

Audiographic conferencing combines computers and audio communications. Usually, this involves the use of PCs (to support computer-to-computer conferencing) and telephones so that students can interact with the computer presentation while consulting by telephone with the instructor, other students, and/or experts. The following table applies the criteria to the use of audiographics as the primary instructional medium.

Criteria	Application to Audiographics	Effectiveness
Developmental Effort	Requires advanced planning to provide handouts with agenda, instructional material, prerequisite assignments, etc. Moderately difficult to set up conference on short notice.	-
Convenience of Instruction	Requires all participants to meet/connect at a specific time.	-
Student Motivation	Provides real-time communications, collaboration, and interaction.	+
Equipment/Support Requirements	Requires a telephone, or speakerphone for larger groups, and reliable access to a computer, network system, and/or fax machine as applicable.	-
Instructor Requirements	Can be difficult to manage, particularly with larger groups.	+
Level of Interactivity	Allows everyone to participate and interact. Although large numbers can be accommodated, it is generally more effective if the numbers are limited to ensure active participation and interaction by all.	+
Feedback Capability	Provides immediate verbal feedback. Some visual feedback can also be provided if on-line application sharing is incorporated.	+
Ease of Revision	The real-time nature of the instruction allows for some immediate changes and revisions if required.	+
Ease of Use	Telephone technology is familiar to instructors and students. However, some degree of instructor computer literacy and training will be required.	-
Versatility	Can be used in conjunction with, and provide effective instructional support for, other types of instruction.	+

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Audiographics (continued)

Potential Applications

Applications of audiographics include:

- Courses that require large amounts of electronic graphic data transfer (e.g., engineering and technical data).
- For document sharing, and joint development or collaboration on projects/tasks.

Audiographics Cost/Benefit Considerations

Relatively inexpensive and, depending on existing computer networking, may not involve significant infrastructure investments.

Compression rate: It is estimated that a distance learning audiographic-based course will reduce the instructional time required to cover the same material in a resident course by 25%.

Estimated development time: If used as the primary means of instruction, support materials (syllabus, handbooks, guides, etc.) would be required. Refer to analysis of medium selected for distribution of such materials (print, audioconferencing, etc). Computer graphics and data must be prepared. Use the following development estimates (per hour of compressed instruction):

Low Complexity	Moderate Complexity	High Complexity
25 hours	50 hours	75 hours

Computer-Mediated Conferencing

Criteria Applied to Computer-Mediated Conferencing

The following table applies the criteria to the use of computer-mediated conferencing as the primary instructional medium. Computer-mediated conferencing incorporates asynchronous communications conducted by means of computers – it includes conferencing software, electronic bulletin boards, and/or e-mail. Computer-mediated conferencing also includes synchronous communications conducted by means of computers. Pop-up mail is a simple example of real-time (synchronous) computer conferencing.

It is important to recognize that while computer-mediated conferencing used to mean communication by written word, technological advances and the use of collaborative technologies have blurred the dividing line between computer-mediated conferencing and other forms of electronic video and audio conferencing, such as virtual conferencing.

Criteria	Application to Computer-Mediated Conferencing	Effectiveness
Developmental Effort	Requires some advanced planning and time to develop and post discussion topics and reference information. Relatively easy to set up an electronic "discussion" on short notice.	+
Convenience of Instruction	Allows participants to communicate and interact independent of time and distance.	+
Student Motivation	Promotes collaboration, interaction, and self-learning. Can be used effectively as a primary media for instruction. Unless required and enforced, students may not participate or respond.	+/-
Equipment/Support Requirements	Requires reliable and consistent access to a properly configured network computer.	-
Instructor Requirements	Can be difficult to monitor and facilitate electronic discussions and send/reply to E-mail messages with large groups; difficult to monitor student participation and progress.	-
Level of Interactivity	Allows everyone to participate and interact. Although large numbers can be accommodated, it is generally more effective if the total number of participants is limited to encourage active participation and interaction by all.	+
Feedback Capability	Can provide timely dissemination of information and feedback to participants. Users may experience difficulty following discussion threads and receiving feedback due to the potentially large volume of messages.	+/-
Ease of Revision	The flexible nature of electronic discussions allows for some immediate changes and revisions to ongoing discussions or information as required.	+
Ease of Use	Some degree of computer literacy and training will be required for participants to ensure effective use.	-
Versatility	Can be used in conjunction with, and provide effective instructional support for, other types of instruction.	+

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Computer-Mediated Conferencing (continued)

Potential Applications

Computer-mediated conferencing traces its history to more than 20 years ago when it was first created for instruction. Since then, its use has blossomed to hundreds of institutions using it for continuing education, graduate courses and supplemental programs. Computer-mediated conferencing is most effective in the following situations:

- Short courses.
- Courses designed to promote higher order learning such as analysis, synthesis, and evaluation.
- Group discussion is required – seminars and talks.
- Courses requiring cooperative learning or group learning.
- Courses requiring written products.
- Ideal for course where learners are encouraged to share their own personal experiences.
- Useful for handicapped learners.
- Used in conjunction with other media.
- In support of correspondence or other distance learning courses where students must submit materials; also facilitates effective feedback to students.

As part of an overall course of study, computer-mediated conferencing may be used to establish a bulletin board which could be accessed by students and others, whether geographically separated or not. Correspondence with experts, posting of web sites for research, and sharing of development projects are facilitated through computer-mediated conferencing.

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Computer-Mediated Conferencing (continued)

Computer-Mediated Conferencing Cost/ Benefit Considerations

Some of the many compelling reasons to use computer-mediated conferencing include:

Cost	One of the least expensive technologies.
Accessibility	More and more learners are gaining access to the Web.
Expanded faculty	Great for guest lecturers since it is easy to connect them.
Interactivity	Because everyone must participate to learn, this is perhaps the most interactive form of distance learning.
Convenience	Not necessarily tied to a specific location or time.
Asynchronous communication	24-hour a day accessibility; enables self-pacing. Provides time for reflection, research, composing.
Synchronous communication	Can design "live" interaction using structured chat rooms.
Versatility	Can be used with other instructional technologies
Currency	Easy to update course materials.
Scaleability	Can talk to one site or many with the potential for global connectivity.
Learner-centered	Focuses on the needs of the learner.
Audit trail	Provides documentation or transcript of interaction; can track who is contributing.
Promotes teamwork	Fosters more learner-to-learner interaction through discussion, guided projects, and individual conversations.

Computer-Mediated Conferencing (continued)

Constraints in Using Computer-Mediated Conferencing

The drawbacks to using computer-mediated conferencing include the following:

- ***Requires Web access*.** Requires proprietary software or Web access. Requires learners and instructors to use Web browsers for Internet-based Instruction (IBI).
- ***Equipment training*.** Assumes learners and instructors are conversant in using the equipment and technology to access the Web.
- ***Can be impersonal*.** Can make some participants feel isolated since they cannot see non verbal cues or body language; in addition, medium is difficult to express emotions.
- ***Assumes a mature learner*.** Requires a more disciplined, responsible learner as well as one that has good time management skills.
- ***Limited number of students*.** While it can be connected to hundreds, is more effective if class size is limited to fewer than 30 learners.
- ***Geared to verbal learners***. Learners not able to clearly express themselves using the written media may be at a disadvantage.
- ***Susceptible to technical problems***. Medium is vulnerable to technical failures, software/hardware compatibility problems.
- ***Time consuming*.** Responding to high volume of traffic is time consuming and may inhibit in-depth discussion.
- ***Cultural resistance***. Faculty and learners may resist this alternative instructional approach or may not view it as "real training/education".
- ***Multithreads*.** More than one conversation may take place simultaneously making it difficult to keep them separate.

Compression rate: It is estimated that a distance learning CMC-based course will reduce the instructional time required to cover the same material in a resident course by 35%.

Estimated development time: Usually employed as a support medium. If used as the primary means of instruction, support materials (syllabus, handbooks, guides, etc.) would be required. Use the following development estimates (per hour of compressed instruction):

Low Complexity	Moderate Complexity	High Complexity
50 hours	125 hours	250 hours

Interactive Multimedia Instruction

IMI

The Interactive Multimedia Instructional technologies addressed in this section are: Interactive Courseware (ICW); Intelligent Computer Assisted Instruction (ICAI); Electronic Performance Support System (EPSS)/Job Performance Aid (JPA); and Computer Simulation.

Criteria Applied to ICW

The following table applies the criteria to the use of interactive courseware (ICW) as the primary instructional medium. ICW is usually employed as a self-paced, asynchronous form of instruction. An ICW-based course may be distributed electronically, by disk, or (as technology is improving) may be downloaded from the Internet.

Criteria	Application to ICW	Effectiveness
Developmental Effort	Requires significant advanced planning and lead-time. Requires experienced instructional designers and developers, full storyboarding and scripting, and considerable resources and support.	-
Convenience of Instruction	Usually independent of time and distance. Most ICW is developed for individual use rather than group or cooperative learning environments. Students can proceed at their own pace.	+
Student Motivation	A high level of learning normally takes place because of the stimulation of multiple senses and the high degree of interaction. There is usually reduced learning time as compared to traditional delivery of the same material. However, students need to be highly motivated to ensure effective comprehension and timely completion of the instruction.	+
Equipment/ Support Requirements	Requires reliable and consistent access to a properly configured computer, and availability of technical support. Courseware must contain student "help" functions if an instructor/proctor is not present or available to answer questions. Presentation software is sometimes required.	-
Instructor Requirements	ICW applications generally reduce instructor requirements. Help functions can also be incorporated into the software to assist students.	+
Level of Interactivity	High level of student interaction with the medium and instructional content is possible. In a DL environment, the lack of instructor/student interaction can be mitigated through the use of CMC and other communications support media.	+
Feedback Capability	Provides immediate and effective feedback to the student that can increase student motivation.	+
Ease of Revision	Revisions to computer-based instruction require significant time, effort, and resources.	-
Ease of Use	Some degree of computer literacy and proficiency training will be required for students to ensure their effective use of the instructional media.	-
Versatility	Can be used in conjunction with, and provide effective instructional support for, other types of delivery methods such as instructor-led, group-paced instruction. ICW is easily stored – makes it ideal for student review and remediation; provides for consistent learning experience.	+

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Interactive Multimedia Instruction (continued)

Potential Applications

Consider ICW when:

- Realism and/or simulation are required.
- Course content is relatively stable (no more than 25% change per year).
- Course content contains some affective and psychomotor skills.
- Self-paced instruction is an option.
- Safety is a factor – ICW simulations offer a non-threatening, safe practice environment.
- Large numbers of widely dispersed students must be trained.

ICW Cost/Benefit Considerations

Computer-based instruction, whether it is an electronic performance support system, a three-dimensional simulation, or a linear presentation requires experienced instructional designers and developers.

ICW development can be relatively costly if the computer hardware, instructional networks, and support are not already in place. However, the potential decrease in training time is 35%.

Compression rate: It is estimated that a distance learning ICW-based course will reduce the instructional time required to cover the same material in a resident course by 35%.

Estimated development time: Use the following development estimates (per hour of compressed instruction):

Low Complexity	Moderate Complexity	High Complexity
50 hours	265 hours	700 hours

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Interactive Multimedia Instruction (continued)

Criteria Applied to ICAI

Intelligent Computer Assisted Instruction (ICAI) is ICW with a brain. The courseware is programmed to respond to student actions and tailors the course of instruction accordingly. Because of the analysis required to anticipate student responses and the additional programming required to make the ICW "intelligent" course content must be stable and courseware developers must be highly skilled. The following table applies the criteria to the use of ICAI as the primary instructional medium.

Criteria	Application to ICAI	Effectiveness
Developmental Effort	Requires a considerable amount of time and effort to develop an expert model/system. Experienced instructional designers, developers, and programmers with unique skills/expertise are required, and they are not normally available in-house.	--
Convenience of Instruction	Usually independent of time and distance. Most ICAI is developed for individual use rather than group or cooperative learning environments. Students can proceed at their own pace. High-end equipment is sometimes required.	+
Student Motivation	A high level of learning normally takes place because of the stimulation of multiple senses and interactivity. There is usually reduced learning time as compared to traditional delivery of the same material. Because course content is tailored on the basis of student response, ICAI is usually more effective than traditional ICW.	++
Equipment/Support Requirements	Requires reliable and consistent access to training equipment or properly configured computer as applicable, and availability of technical support.	-
Instructor Requirements	Reduces instructor requirements. An expert system recognizes mistakes commonly made by students, and can detect and diagnose errors, and present information to correct misconceptions that would normally require an instructor.	+
Level of Interactivity	Very high level of student interaction with the medium.	++
Feedback Capability	Provides immediate and effective feedback and instruction to the student, that can increase student motivation.	++
Ease of Revision	As with the development of ICAI systems, corrections and revisions to the instruction take even more time and expertise than revisions to ICW programs.	--
Ease of Use	Some degree of computer literacy and proficiency training may be required for students to ensure their effective use of the instructional media.	-
Versatility	Can be used in conjunction with, and provide effective instructional support for, other types of delivery methods such as instructor-led, group-paced instruction. ICAI is easily stored – makes it ideal for student review and remediation; provides for consistent content and varied learning experiences.	++

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Interactive Multimedia Instruction (continued)

Potential Applications

ICAI provides an excellent medium for instruction and performance measurement of:

- Problem solving cognitive skills (the highest level of knowledge).
- Diagnostic and troubleshooting skills (Judgment and Decision-Making Knowledge and Skills).

It is also excellent for remediation as feedback is immediate and, depending on the sophistication of the system, the system will automatically take the student through various approaches to a given concept until student responses indicate that the student has mastered it.

ICAI Cost/Benefit Considerations

ICAI systems have the potential to instruct, diagnose, evaluate, and individualize instruction and remediation. However, development is generally labor intensive and requires unique skills/expertise.

Because of the expense involved in development of expert systems, they are usually reserved for teaching high-risk knowledge and decision-making skills. Such training may be an appropriate and cost-effective way to prepare military personnel for major military exercises, for example. ICAI is also used to develop skills which cannot be practiced during field or laboratory exercises (e.g., handling of nuclear material). In this case, the cost/benefit analysis would have to examine what the cost will be if the target population does not get this type of training.

Compression rate: It is estimated that a distance learning ICAI-based course will reduce the instructional time required to cover the same material in a resident course by 35%.

Estimated development time: It could take 2-4 years to develop, test, and refine an expert instructional system. Use the following development estimates as minimums (per hour of compressed instruction):

Low Complexity	Moderate Complexity	High Complexity
250+ hours	600+ hours	1,000+ hours

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Interactive Multimedia Instruction (continued)

Criteria Applied to EPSSs/JPAs

Electronic Performance Support Systems/Job Performance Aids (EPSSs/JPAs) are frequently employed to provide on-line assistance to individuals so they can perform their job tasks with minimal support and intervention by others; they are designed to support performance of specific job skills. They may be incorporated into formal training programs to help students learn how to use them effectively on the job, but are most often developed to support on-the-job skill development. EPSSs/JPAs are typically single-purpose tools used during actual operations to help technicians perform in a more effective, efficient, timely, or cost-effective manner. The following table applies the criteria to the use of EPSSs/JPAs as the primary instructional medium.

Criteria	Application to EPSSs/JPAs	Effectiveness
Developmental Effort	Requires significant advanced planning and lead-time. Very difficult to develop an EPSS/JPA with an integrated expert system. Requires experienced instructional designers and developers with unique skills/expertise, normally not available in-house.	-
Convenience of Instruction	Enables the user to gain rapid access to large amounts of information/instruction on demand from the work site.	+
Student Motivation	Increases user productivity and job/task performance. Reduces training time/requirements. Motivation is maintained because information is delivered on demand and is directly related to job performance.	+
Equipment/Support Requirements	Requires EPSS/JPA delivery equipment/system availability at each work site/station for user access.	-
Instructor Requirements	Reduces instructor/expert support requirements. Allows users to perform tasks with a minimum amount of external intervention or training normally requiring an instructor.	+
Level of Interactivity	High level of user interaction with the support system content and intelligent tutoring system is possible.	+
Feedback Capability	Provides immediate feedback to the user.	+
Ease of Revision	As with other similar computer-based applications, it takes some time, effort, and resources to develop and implement revisions to an EPSS/JPA.	-
Ease of Use	Some degree of computer literacy and/or equipment training will be required for users to ensure effective use of the EPSS/JPA.	-
Versatility	EPSSs/JPAs are retained and available in an electronic format at the work site for reference on demand when required. Requires much less physical storage than paper-based aids/manuals.	+

Continued on the next page

Interactive Multimedia Instruction (continued)

Potential Applications

Consider using Electronic Performance Support Systems/Job Performance Aids when:

- Providing on-the-job training for development of low-risk skill sets. Trainees can access the information whenever required.
- Providing reinforcement after formal training; use of the EPSSs/JPAs can be addressed during the formal training so that optimum use can be made of the EPSSs/JPAs when the user returns to the workplace.
- There is a need to reduce formal training time; effective support tools at the job site can reduce the requirement for formal training.

EPSS/JPA Cost/Benefit Considerations

EPSS/JPA costs and effectiveness vary depending on the complexity of the support system. Task performance time can be reduced by as much as 50%.

- A very basic and less costly EPSS/JPA may only provide a database and an on-line help system.
- A complex EPSS/JPA can include a hypermedia database, interactive courseware, an expert system, and a dynamic maintenance system which, like ICAI, could require significant development time, expertise, and cost.

Estimated development time: Varies according to complexity of the system.

Continued on the next page

Interactive Multimedia Instruction (continued)

Criteria Applied to Computer Simulation

Computer simulation techniques allow the learner to practice procedures and solve problems in a life-like, safe learning environment. While these techniques can be employed using print or other non-electronic media, this examination of the technology assumes the use of computers as part of the simulation process. The following table applies the criteria to the use of computer simulation as the primary instructional medium.

Criteria	Application to Simulation	Effectiveness
Developmental Effort	Requires significant advanced planning, lead-time, resources, and effort. Expertise is required to reduce the desired learning objectives to algorithms that capture real-world events. Software is complex and generally costly to develop and test - significant prototyping and testing of the instructional simulation program are required.	--
Convenience of Instruction	Simulation instruction may be developed for individual or group use. Group participation is less flexible since participants must start/interact at the same time. Because simulation training is normally accomplished in real-time, the student has less control of the sequence and pacing of the presentation.	-
Student Motivation	A high level of learning normally takes place because of the realistic presentation and interaction provided.	++
Equipment/Support Requirements	Requires access to the simulation computer/equipment, and availability of technical support. Development platforms required.	-
Instructor Requirements	Requires instructor monitoring, supervision, management, and/or participation.	-
Level of Interactivity	Simulations provide a real-world learning environment and allow active “hands on” participation and performance of tasks in a safe environment.	++
Feedback Capability	Participants and simulator provide immediate and realistic feedback to the student which can increase student motivation.	+
Ease of Revision	As with development, significant time, programming skills and expertise are required for changes and revisions.	-
Ease of Use	Some degree of computer literacy and proficiency training will be required for students to ensure their effective use of the computer simulation instructional media.	-
Versatility	Can be used in conjunction with, or to replace, training accomplished using actual equipment or other media. Can be used following formal training to permit transition between the laboratory and the real world – to permit students to practice what they have learned in a safe environment.	++

Continued on the next page

Interactive Multimedia Instruction (continued)

Potential Applications

- Excellent medium for training procedural tasks and simulating "hands-on" equipment operation.
- Can support experimentation ("what if...") without expenditure of critical resources.
- Effective tool to practice life-threatening skills in a non-threatening environment.
- Simulation methods can be employed to provide instruction, assess/track performance, or provide remediation as required.

Simulation Cost/Benefit Considerations

Simulation provides very effective instruction and training in complex skills that would otherwise require actual performance of those skills in the operational environment. A significant cost savings may be realized if simulation is used vice operational equipment.

Cost varies significantly depending on the fidelity of the simulation and the delivery equipment required (training device). Since high (physical) fidelity simulation comes at a considerable cost, it must be determined how closely the simulation needs to duplicate the real performance tasks.

Development requires careful scripting; talent must often be hired for the final narration.

Compression rate: It is estimated that a distance learning simulation based course will reduce the instructional time required to cover the same material in a resident course by 35%.

Estimated development time: Use the following development estimates (per hour of compressed instruction):

Low Complexity	Moderate Complexity	High Complexity
250 hours	600 hours	1,000+ hours

Interactive Video Teletraining

Criteria Applied to ITV

Interactive Video Teletraining (IVT) comprises two technologies: Interactive Television (ITV) and Video Teleconferencing (VTC). The following table applies the criteria to the use of ITV as the primary instructional medium. ITV provides one-way, site-to-site, or site-to-multiple site, transmission of audio and video instruction from a studio classroom to distance learning classrooms equipped with television monitors and student response units.

Criteria	Application to ITV	Effectiveness
Developmental Effort	Requires advanced production planning, coordination, and development efforts. Requires training for instructors.	-
Convenience of Instruction	Live lessons are scheduled only at specific times and because ITV broadcasts are accomplished in real-time, the student has little control of the timing, sequence, and pacing of the instruction. Success is also contingent on a host of technologies working without problems. Transmission/reception problems can interfere with flow of instruction. Has the advantage of distance learning in that the student does not have to travel to the training site at which the training is being conducted.	+/-
Student Motivation	Can provide a cost-effective means for conducting live, full motion quality training to large number of students at widely dispersed locations. Allows instructors to communicate visually and be seen by students at remote locations.	+
Equipment/Support Requirements	Requires special satellite uplink/downlink and production equipment. Requires the availability of studio facilities and student access to ITV classrooms. Facilitator training and technical support are required to ensure efficient and effective operations.	+
Instructor Requirements	Requires active preproduction planning, coordination, rehearsals, and formal instructor training to ensure successful ITV instruction. But overall instructor requirements may be reduced if multiple iterations of the course are planned.	-/+
Level of Interactivity	Provides verbal communication and interaction by the students; but there is little direct interaction with the medium.	+
Feedback Capability	Allows for immediate verbal and visual feedback to the student. However, instructors cannot visually observe or receive visual feedback from the students.	+/-
Ease of Revision	Live broadcasts allow for immediate changes to the instruction.	+
Ease of Use	Students and DL site facilitators will require training in the use of equipment.	-/+
Versatility	Can be used in conjunction with, or to replace, training accomplished using other media.	+

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Interactive Video Teletraining (continued)

Criteria Applied to VTC

Video Teleconferencing (VTC) provides two-way, site-to-site, or site-to-multiple site video and audio instruction, simultaneously transmitted over satellite or terrestrial lines. The following table applies the criteria to the use of VTC as the primary instructional medium.

Criteria	Application to VTC	Effectiveness
Developmental Effort	Requires more advanced planning, preparation, organization and coordination than ITV.	-
Convenience of Instruction	Live lessons are scheduled only at specific times, and because VTC broadcasts are accomplished in real-time, the student has little control of the timing, sequence and pacing of the instruction. Success is also contingent on even more technologies working without problems. Transmission/reception problems can interfere with flow of instruction. Has the advantage of distance learning in that the student does not have to travel to the training site at which the training is being conducted.	+/-
Student Motivation	Can provide a means for conducting live, full-motion interactive video training. Allows two-way visual and audio communications between the participants at the remote locations. Provides wider access to instructors/ subject matter experts.	+
Equipment/Support Requirements	Requires special production equipment at all participating sites. Requires the availability and access to VTC facilities and classrooms. Facilitator training and technical support are required at all sites to ensure efficient and effective operations. VTC systems for education and training are not widely available in the AF.	-
Instructor Requirements	Requires active preproduction planning, coordination, rehearsals, and formal instructor training to ensure successful VTC instruction. But overall instructor requirements may be reduced if multiple iterations of the course are planned.	-/+
Level of Interactivity	Provides for verbal and visual communications and interaction among the participants. The number of sites and students may need to be limited to allow adequate interaction and direct observation of the students by the instructor.	+
Feedback Capability	Allows for immediate verbal and visual feedback at selected sites.	+
Ease of Revision	Live broadcasts allow for immediate changes to the instruction.	+
Ease of Use	Requires training for instructors, students, and facilitators in the use of the VTC communications equipment at all sites.	-
Versatility	Can be used in conjunction with, or to replace, training accomplished using other media.	+

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Interactive Video Teletraining (continued)

Potential Applications

Consider using IVT technologies when:

- Many iterations of the same course are planned and projected travel costs for attendees are substantial.
- There is an emergency training requirement to train a large number of geographically separated people in a short period of time.
- Special or one-time training will be conducted by a subject matter expert and attendees are geographically separated – or subject matter expert cannot be physically present.
- ITV applications are suitable for large audiences when there is no requirement for the instructor to observe student performance.
- VTC is suitable for applications involving a limited number of sites or limited student enrollments.

IVT Cost/Benefit Considerations

Since VTC lessons increase satellite uplink/bandwidth requirements, equipment, and support costs, the necessity of two-way video communication for delivery of instruction and accomplishment of learning objectives must be considered. Also, scrambling of the IVT transmission will require additional equipment, personnel, and increase costs.

The use of existing networks and facilities or the ability to lease networks and facilities can drive the decision to use ITV instead of VTC. Air Force users should leverage the existing ATN, Warrior Network, and GEWTN infrastructure.

Compression rate: It is estimated that a distance learning IVT-based course will reduce the instructional time required to cover the same material in a resident course by 20-30%.

Estimated development time: Use the following development estimates (per hour of compressed instruction) (excludes rehearsals and broadcasts):

Low Complexity	Moderate Complexity	High Complexity
10 hours	90 hours	250 hours

Internet Based Instruction

Criteria Applied to IBI

Internet Based Instruction (IBI) is instruction that makes use of Internet technologies. The following table applies the criteria for instruction that combines text, multimedia, and conferencing techniques delivered over the Internet.

Criteria	Application to IBI	Effectiveness
Developmental Effort	Requires careful planning, coordination, and support to fully develop and integrate the IBI technologies into an effective and efficient instructional system.	-
Convenience of Instruction	Can be synchronous or asynchronous, self-paced or group-paced. Allows participants to communicate and interact independent of time and distance.	+
Student Motivation	When properly developed and employed, IBI can facilitate a high level of learning. Capable of combining self-paced instruction with group and instructor interaction.	++
Equipment/ Support Requirements	Requires reliable and consistent access to a properly configured networked computer, and availability of technical support. An on-line student "help desk" is necessary if an instructor, facilitator, or proctor is not always available to answer questions.	-
Instructor Requirements	In addition to instructing, the instructor must also facilitate, moderate, and manage student discussions and interactions. Life cycle instructor requirements may be reduced by converting course to text or multimedia format. Virtual conferencing may increase instructor life cycle requirements.	-
Level of Interactivity	High level of student interaction with the instructor, other students, and the instructional content is possible.	+
Feedback Capability	Provides various feedback vehicles and methods; feedback mechanisms must be built into asynchronous training programs.	+
Ease of Revision	The Internet is used for the distribution of training materials; the format of that material dictates the relative ease/difficulty of the revision process. Users have immediate access to course updates.	+/-
Ease of Use	Some degree of computer literacy and proficiency training will be required for instructors and students to ensure they can use the instructional media effectively.	-
Versatility	The various IBI technologies can be employed separately as the primary instructional delivery medium, or used in collaboration with each other as an integrated instructional system.	+

Potential Applications

IBI is appropriate when:

- Students are widely dispersed and real-time interaction is required between students and instructors.
- Rapidly changing electronic data must be transferred to students.

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Internet Based Instruction (continued)

IBI Cost/Benefit Considerations

The Internet is used for the distribution of training materials; the format of that material dictates the development time and life cycle costs of the training materials.

Compression rate: It is estimated that a distance learning IBI-based course will save the following estimated percentages of the instructional time required to cover the same material in a resident course.

- 25% if text-based
- 35% if multimedia-based
- 0% if virtual conferencing-based

Estimated development time: Refer to medium selected for development of training materials. Ensure adequate testing and quality review of materials is built into the schedule and that materials to be transmitted over the Internet can be downloaded and/or managed by the receiving systems.

Support Technology

Introduction

By definition, support technologies are used to support, or augment, instructional programs. They may be integrated into the instructional program or be used in conjunction with other technologies as separate components of the instructional program. In this section, each support technology is examined in terms of its strengths and weaknesses when employed to support the other technologies used as the primary means of delivering training.

Electronic Testing

The strengths and weaknesses of electronic testing are summarized as follows:

Strengths

- Automates the testing process and eliminates the task of manually tabulating, recording, and assessing the test results.
- Provides for random selection of test items and creation of individualized tests.
- When properly designed, developed, and employed, electronic testing can instruct, as well as evaluate.
- High level of student interaction with test content is possible.
- Provides immediate feedback on student performance – provides immediate test results.
- Provides for electronic storage and retrieval of test data which facilitates timely updates/revisions and better version control.
- Reduces future time and effort required to administer and manage the testing.
- Can be employed as standalone support tool or integrated into a computer-based instructional program.

Weaknesses

- Requires some planning and coordination to effectively design, develop, and integrate electronic testing capabilities into an instructional program.
- Requires reliable and secure access to a properly configured computer.
- Security is an issue. Verification is required to ensure that the individual taking the test is indeed the student. An instructor, facilitator, or proctor is usually required to verify student identification and monitor the testing.
- Formal testing is normally a structured activity requiring students to participate at a specific time and location.
- Some degree of computer literacy and training will normally be required for instructors and students to ensure they can effectively use of the instructional media for testing purposes.

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Support Technology (continued)

CMI

The strengths and weaknesses of computer-managed instruction (CMI) are summarized as follows:

Strengths

- Reduces instructor time required for development and management of class data.
- Can provide timely feedback on student status and performance (progress reports are easily produced).
- Reduces time and effort required for student administration and management.
- Generally transparent to the student.
- Usually embedded in ICW; no special development or delivery equipment required.
- Revision capability usually built into CMI software; updates accomplished with relative ease.
- Greatly facilitates data collection and management relative to the instructional program (numbers of students trained, location of trainees, attrition rates, etc.)

Weaknesses

- Requires some planning and coordination to design, develop, and integrate CMI capabilities effectively into an instructional program.
- Requires development software (though usually embedded in authoring systems) and skilled developers.
- Some degree of computer literacy and training will normally be required for instructors and students to access CMI data.
- When used with other than ICW, separate equipment may be required.

Continued on the next page

Support Technology (continued)

Electronic Help Desk The strengths and weaknesses of the Electronic Help Desk are summarized as follows:

Strengths

- Provides quick response to student inquiries, increasing sense of interaction.
- If purely electronic, there is minimal cost once established.
- Easy way to provide reference materials to students – prevents having to e-mail materials to individuals; enables students to answer their own questions.

Weaknesses

- Mechanisms must be established to address all user contacts, either through direct response or through referrals.
- Help desks must be staffed with knowledgeable people; there may be a requirement for extended hours to support students of distance learning programs who may be studying during non-business hours.
- If student responses are not addressed in a timely manner, student interest could be negatively affected.
- Maintaining the help desk and ensuring help desk staff have complete and accurate information requires planning and coordination.
- The student-to-help desk support personnel ratio must be calculated realistically. Like instructors who are expected to respond to hundreds of e-mails while teaching a regular course load, help desk personnel can be inundated with requests – the end result is poor quality service.
- For purely electronic help desks, an effective search engine may be required to facilitate student research on a help topic.

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Support Technology (continued)

Electronic Publications

The strengths and weaknesses of electronic publications, including interactive electronic technical manuals (IETMs), are summarized as follows:

Strengths

- Enables the user to gain rapid access to large amounts of information on demand during training or at the work site.
- When properly designed, developed, and employed, IETMs provide search capabilities that can instruct as well as provide information.
- Hypertext can be incorporated to facilitate linking to related sections internal to the IETM, or, if employed on Internet-capable system, to related websites on the Internet.
- Reduces instructor/expert support requirements. Allows users to access necessary information and perform tasks with a minimum amount of external intervention or training.
- High level of user interaction and branching with the IETM support system content is possible.
- Generally, user-friendly. Some training will normally be required for instructors and students to ensure they can effectively access and use the available information.
- Can be employed separately (portable), or integrated into the instructional system (can become an effective Job Performance Aid).

Weaknesses

- The time, resources, and effort required to develop an IETM vary depending on the complexity and content of the application. Careful planning, coordination, and support will be required to fully integrate IETM into an instructional system.
- Requires IETM delivery device/computer availability at each work site/station for user access.
- Revisions are usually costly; best used for stable designs. It is feasible to accomplish minor database/technical information updates in a relatively short period of time if required.

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Support Technology (continued)

Electronic Support	The strengths and weaknesses of e-mail, electronic bulletin boards (EBB), and fax conferencing are summarized as follows:
E-Mail Strengths	• Facilitates individualized student-instructor communications in a distance learning environment. • Can be used to communicate with students before they attend a resident course of instruction (to lessen course time spent on administrative matters). • User-friendly; requires minimal user training.
E- Mail Weaknesses	• Can require a significant amount of instructor time if total student population is large. Instructor support may be required to handle communications in a timely manner. • E-mail is vulnerable to failure.
EBB Strengths	• Facilitates announcements to all participants (e.g., assignments; conferencing times/locations; responses to frequently asked questions). • Not time-dependent; users can access information at any time. • After initial set-up, requires little preparation. • Minimal computer literacy required to access and employ EBB.
EBB Weaknesses	• Requires technical support for set-up and administration of EBB (e.g., adding new users). • EBBs can be filled with junk mail; limits on posting access rights may be required. • Security is an issue – unless encrypted, virtually anything placed on the internet can be accessed by others.

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Support Technology (continued)

Fax Conferencing Strengths	• Facilitates transfer of technical data; useful when supporting audio and/or video conferencing. • Equipment requirements are minimal. • User-friendly; requires minimal user training.
Fax Conferencing Weaknesses	• Faxing to multiple sites can interrupt flow of interactive conferences. • Quality of faxed copy is highly variable. • Requires access to fax machine.
Voice Mail	The strengths and weaknesses of voice mail are summarized as follows:
Strengths	• Minimal set-up and maintenance. • Provides inexpensive vehicle for asynchronous communications between instructors and students in support of DL or resident instruction. • User-friendly; requires minimal user training. • Capable of screening and routing incoming student calls.
Weaknesses	• Voice mail capacity may be limited; student frustration could be a problem if prevented from leaving messages due to capacity limits. • Like e-mail, voice mail can require a significant amount of management on the part of the instructor or administrative personnel if student population is large. • While voice messages can be archived, there is usually a capacity limit – there is no communication trail to document commitments/expectations or other decisions reached. • Computer-based voice mail requires special equipment and software – not yet widely used.

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Support Technology (continued)

Student Response Units	The strengths and weaknesses of student response units (SRUs) are summarized as follows:
Strengths	• Provides for confidential student responses so that instructor can assess student understanding without embarrassing students. • Facilitates reinforcement of learning. • Provides for data collection so that instructional staff can analyze student responses and identify areas of instruction needing improvement. • Can be used effectively to support brainstorming, team building, and consensus building activities. • User-friendly; requires minimal user training.
Weaknesses	• Requires some preparation to structure the learning experience to make the most of SRU capabilities. • Requires special equipment and instructor familiarity with the capabilities of SRUs. • May be expensive to implement.

Section C

Curriculum Analysis and Media Feasibility

Overview

This section describes the steps for conducting a curriculum and media feasibility analysis – the analytical process of identifying and prioritizing media based on their capability to accomplish instructional goals. The process incorporates several phases:

- Review of learning objectives and levels of learning.
- Identification of instructional modules that appropriately group objectives into manageable chunks of instruction.
- Assessment of the importance of instructional design characteristics and strategies.
- Comparative analysis of the capability of various media to satisfactorily fulfill the instructional design characteristics.

The media feasibility analysis is designed for use by the IT project manager/instructional designer with ultimate responsibility for conducting a front-end analysis (FEA). It must be completed in conjunction with the course manager or primary customer capable of providing course and student data.
The purpose of this analysis, when combined with an initial resource and infrastructure analysis and a comparative cost analysis is to identify viable, cost-effective technology options.

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Curriculum Analysis and Media Feasibility (continued)

Background

The media feasibility process begins only after the needs analysis, task analysis, and objectives and tests have been accomplished. A needs assessment is completed by the training/course manager, or in some cases by a career field functional manager, to identify appropriate solutions to defined problems. If the needs assessment identified a training problem or an educational deficiency, then a task analysis (educational elements refer to this as an instructional requirements analysis) is performed to define the content of what should be taught. This leads to defining specifically what a learner will do with the content by clearly writing learning objectives and tests. At this point, a media feasibility analysis should be performed.

Task Analysis

The *Task Analysis* identifies the *types of learning*, i.e., the *Knowledge, Skills, and Attitudes* (KSA), that are required for a new IT-based lesson. KSAs are the human performance factors that are required to perform a job task:

- **Knowledge** is what an individual needs to know before performing a procedure under *normal conditions*. This is the ability to recognize and state facts, rules, procedures, discriminations, and problem solutions that are related to the performance of normal procedures. *Knowledge* must be retained in long-term memory (cognitively internalized) prior to performance of job tasks (educational elements refer to this as cognitive activities).
- **Skills** are what an individual physically needs to be able to do in performing a procedure under *normal conditions*. These are the physical abilities or actions that are associated with the performance of normal procedures (educational elements refer to this as behavioral activities).
- **Attitudes** are the *Judgment and Decision-Making (JDM) Knowledge* and *Skills* that an individual needs to apply in response to *abnormal or emergency condition cues* encountered during the performance of normal procedures. *Attitudes* encompass *Situational Awareness Knowledge* and *Resource Management Skills (countermeasures)* for abnormal and emergency conditions (educational elements refer to this as affective activities).

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Curriculum Analysis and Media Feasibility (continued)

Task Analysis (continued)

The *Learning Analysis* defines the *Levels of Learning* for each KSA identified during the Task Analysis process.

- The KSA levels of learning represent a hierarchy of *learning behaviors* from simple to complex.
- With each level of learning, there are associated *action verbs* that describe the *learning behavior*.
- The associated *action verb* and the *performance standard* for each KSA *learning behavior* are determined, and the KSA learning objectives with *learning conditions*, *behavior*, and *performance standards* are documented.
- An outline of instruction is developed for each learning objective, and the learning objectives are sequenced into modules of instruction.

Curriculum and Learning Objective Analysis Steps

Step 1: Identify a particular "piece of instruction" that you will analyze. This piece of instruction may range from a section of a course, to an entire course, to a group of related courses.

Step 2: Collect all related instructional documents and the outline of instruction. Review the objectives to ensure they are clearly written and describe a specific learning outcome.

Step 3: Identify each objective by KSA type based on the behavioral *action verb* (MIL-PRF-29612 and supporting handbooks; AFH 36-2235, Vol. 10).

Step 4: Determine the level of learning and the level of interactivity for each KSA learning objective (MIL-PRF-29612 and supporting handbooks; AFH 36-2235, Vol. 10).

Step 5: Review the instructional methodologies used to teach each learning objective in the current course (AFH 36-2235, Vol. 10).

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Curriculum Analysis and Media Feasibility (continued)

Identification of Instructional Modules Steps

Step 1: Organize the objectives into manageable modules or chunks of instruction. Resequence the objectives if necessary. The following criteria may help you define a module:

- Group by types of objectives - knowledge, skill, or attitude.
- Group optional or supplemental content not required by all students.
- Group content that is self-contained and could be exported independent of the rest of the course.
- Group segments of instruction that are managed or taught by different departments or whose personnel do not have full knowledge of the requirements of the other blocks of instruction.
- Group rapidly changing content that will require frequent updates.

Step 2: Identify specific attributes of each module that might affect conversion to an instructional technology format. For example:

- Course materials are subject to frequent changes.
- Guest speakers from outside the command are used.
- Extensive student research is required.
- Small student-to-instructor ratios are required.
- Extensive student interaction with instructional materials is required.
- A long period of time is required to learn the objective.
- Real-time, one-on-one instructor observation of the student is required to ensure mastery of a skill objective.
- Copyright restrictions.
- Course materials are classified secret or higher.

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Curriculum Analysis and Media Feasibility (continued)

Media Feasibility Steps

After defining the modules and determining the learning objectives that are to be migrated to an instructional technology format, perform the following media feasibility steps for each module:

Step 1. Determine the Importance Factor for each of the following instructional design characteristics that are required to meet the learning objectives associated with a module. Ask: "how important is it that the medium selected be able to accommodate each characteristic". Rate each characteristic on a scale of 0 (least important) to 5 (most important):

	Instructional Design Characteristics	Importance Factor
1.	Allow real-time interaction between students and instructor.	
2.	Allow real-time interaction and collaboration among students (group interaction).	
3.	Provide instructional feedback from programmed or system (non-human) sources.	
4.	Allow self-pacing of instruction.	
5.	Allow learner control of scope and sequence of instruction.	
6.	Support individualized instruction (ability to adapt to learner's needs).	
7.	Support privacy of student inquiry and response.	
8.	Fit various student schedules.	
9.	Allow short-notice changes to the curriculum.	
10.	Support inclusion of job task realism and emulated or simulated job task scenarios.	
11.	Support inclusion of high-quality, color, still graphics.	
12.	Support animated 2D or 3D graphics.	
13.	Support full-motion video.	
14.	Provide high-fidelity audio.	
15.	Support higher levels of knowledge learning (cognitive skills).	
16.	Support higher levels of skill learning (psychomotor skills).	
17.	Support higher levels of attitude learning (Judgment and Decision-Making KSA and affective learning).	
18.	Be retained as a reference tool for later applications.	
19.	Support student accessibility.	
20.	Support sporadic, uneven student loads.	
21.	Provide just-in-time access of stable for a task or procedure.	
22.	Provide just-in-time access to volatile content for a task or procedure.	
23.	Allow observation of performance.	

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Curriculum Analysis and Media Feasibility (continued)

Media Feasibility Steps (continued)

Step 2. Determine each medium's ability to meet each Instructional Design Characteristic. In the following table, Media Feasibility Matrix, each instructional design characteristic is matrixed with types of media. Each medium has been assigned a Rating Score from 0 (cannot meet the characteristic) to 3 (meets the characteristic effectively). The matrix spans two pages and incorporates all media presented.

Multiply the Importance Factor that was determined for each Instructional Design Characteristic by the Rating Score and record the Total Score for each type of instructional medium.

Media Feasibility Matrix

Instructional Design Characteristics	P	AT	VT	AC	AG	CMC
1. Allow real-time interaction between students and instructor.	0	0	0	3	3	3
2. Allow real-time interaction with other students (group interaction).	0	0	0	2	2	3
3. Provide instructional feedback from programmed or system (non-human) sources.	0	0	0	0	3	1
4. Allow self-pacing of instruction.	3	2	2	1	2	3
5. Allow learner control of scope and sequence of instruction.	1	1	1	0	1	3
6. Support individualized instruction (ability to adapt to learner's needs).	0	0	0	1	1	2
7. Support privacy of student inquiry and response.	3	1	1	0	0	0
8. Fit various student schedules.	3	3	3	1	1	3
9. Allow short-notice changes to the curriculum.	1	2	1	3	2	3
10. Support inclusion of job task realism and emulated or simulated job task scenarios.	1	1	2	1	2	1
11. Support inclusion of high-quality, color, still graphics.	3	0	3	0	3	1
12. Support animated 2D or 3D graphics.	0	0	3	0	1	0
13. Support full motion video.	0	0	3	0	2	0
14. Provide high-fidelity audio.	0	3	3	3	3	0
15. Support higher levels of knowledge learning (cognitive skills).	2	2	2	2	2	3
16. Support higher levels of skill learning (psychomotor skills).	1	1	2	1	1	1
17. Support higher levels of attitude learning (Judgment and Decision-Making KSA and affective learning).	2	2	2	2	2	3
18. Be retained as a reference tool for later applications.	3	3	3	2	1	3
19. Support student accessibility.	3	3	3	3	2	3
20. Support sporadic, uneven student enrollments.	3	3	3	1	1	1
21. Provide just-in-time access to stable content for a task or procedure.	3	3	3	2	2	0
22. Provide just-in-time access to volatile content for a task or procedure.	0	2	2	3	3	0
23. Allow observation of performance.	0	0	0	0	1	0

P: PRINT	AT: AUDIOTAPE	VT: VIDEOTAPE	AC: AUDIO CONFERENCING	AG: AUDIO GRAPHICS	CMC: COMPUTER-MEDIATED CONFERENCING

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Curriculum Analysis and Media Feasibility (continued)

Media Feasibility Matrix

Instructional Design Characteristics	ICW	JPA, EPSS	CS	ITV	VTC	IBI TG	IBI MM	IBI VC	IBI DVC
1. Allow real-time interaction between students and instructor.	0	2	0	3	3	0	1	3	3
2. Allow real-time interaction with other students (group interaction).	0	2	0	3	3	0	0	3	1
3. Provide instructional feedback from programmed or system (non-human) sources.	3	3	3	0	0	1	0	1	0
4. Allow self-pacing of instruction.	3	3	3	0	0	3	3	3	0
5. Allow learner control of scope and sequence of instruction.	3	3	3	1	1	3	3	2	1
6. Support ability to adapt to learner's individual learning needs	2	3	2	1	1	2	2	2	0
7. Support privacy of student inquiry and response.	3	3	3	0	0	2	2	0	0
8. Fit various student schedules.	3	3	3	1	1	3	3	2	1
9. Allow short-notice changes to the curriculum.	1	1	1	3	3	3	3	3	3
10. Support inclusion of job task realism and emulated or simulated job task scenarios.	3	3	3	2	2	1	3	1	2
11. Support inclusion of high-quality, color, still graphics.	3	3	3	3	2	2	3	1	1
12. Support animated 2D or 3D graphics.	2	2	3	2	1	0	1	0	0
13. Support full motion video.	3	3	3	3	2	0	2	0	2
14. Provide high-fidelity audio.	3	3	3	3	3	0	2	2	2
15. Support higher levels of knowledge learning (cognitive skills).	2	2	3	2	3	1	2	3	2
16. Support higher levels of skill learning (psychomotor skills).	2	3	3	2	3	1	3	1	2
17. Support higher levels of attitude learning (Judgment and Decision-Making KSA and affective learning)	3	3	3	3	3	2	3	3	3
18. Be retained as a reference tool for later applications.	3	3	3	2	2	3	3	3	0
19. Support student accessibility.	2	2	1	2	1	1	1	1	0
20. Support sporadic, uneven enrollments.	3	3	3	1	1	3	3	1	1
21. Provide just-in-time access to stable content for a task or procedure.	3	3	3	1	1	3	3	0	1
22. Provide just-in-time access to volatile content for a task or procedure.	1	1	1	1	1	3	2	0	2
23. Allow observation of student performance.	0	0	0	0	2	0	0	0	1

ICW: Interactive Courseware	JPA/EPSS: Job Performance Aid/ Electronic Performance Support System	CS: Computer Simulation	ITV: Interactive Television
VTC: Video Teleconference	IBI T/G: Text and Graphics	IBI MM: Multimedia	IBI VC: Virtual Conference
IBI DVC: Desktop Video Conference			

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Curriculum Analysis and Media Feasibility (continued)

Media Feasibility Steps (continued)

Step 3. Calculate the totals for each medium. The Total Score that was computed for each medium indicates the medium's appropriateness for the migration of resident instruction to an instructional technology or distance learning format.

Step 4. Identify potential media. The media receiving the highest Total Scores are potential tools for conversion of resident instruction. This selection process is not a final decision for migration of learning objectives to instructional technology, or for selection of a particular type of media.

- Review the data, and take a hard look at the characteristics that were rated as a "4" or "5" Importance Factor. Ensure that the characteristics merit a high Importance Factor.
- Consider only those distance learning media with the highest Total Scores that are capable of satisfying your critical Importance Factor characteristics and learning objectives.

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Curriculum Analysis and Media Feasibility (continued)

Media Feasibility Software

Commercial software is available to conduct an automated media feasibility analysis that utilizes the model described above. It includes a comparative cost analysis module that will allow you to estimate and compare the costs of various technologies to the cost of traditional classroom instruction. It will generate estimated and actual resource utilization charts, return on investment, and the breakeven point.

To obtain information on how to obtain this software, contact the AFDLO or check the AFDLO Web site.

Other Instructional Technology Selection Models

The Government developed the Automated Instructional Media Selection (AIMS) Model to allocate selected media to specific training objectives for the Air Force Primary Aircrew Training System (AFPATS) Ground Based Training System (GBTS).

- AIMS was developed in 1992 from a synthesis of current instructional delivery technology selection models.
- AIMS derived instructional characteristics and attributes associated with specific learning objectives, and matrixed the instructional characteristics against a pool of available media to define the instructional media which could best deliver the required instructional characteristics of each learning objective.
- The concepts of the AIMS Model have been incorporated in the instructional delivery technology selection process described in:
  - MIL-HDBK-29612-2, *Department of Defense Handbook, Instructional Systems Development/Systems Approach to Training and Education*
  - MIL-HDBK-29612-3, *Department of Defense Handbook, Development of Interactive Multimedia Instruction (IMI)*

Section D

Infrastructure and Resource Feasibility Analysis

Introduction

There are several very important questions that must be answered before the decision is made to actually convert existing courses, or course modules, to distance learning instruction, or before the decision is made to insert technology into the resident program. You must also look at infrastructure and resource requirements.

This feasibility analysis is not intended to be a complete instructional technology resource analysis. Additional detailed information will be required for Front End Analysis (FEA). It will however, give decision-makers an estimate of the relative magnitude of a project and whether or not conversion to instructional technology or distance learning is "do-able" with existing resources. If existing resources are not available, initiate steps to fund and acquire them.

Infrastructure and Resource Issues

- *How critical is the conversion project to mission readiness?*

  Includes a review of the intended goals of the project and an understanding of whether the project is being undertaken because it is mission critical, (resources must be allocated) or to save money (resources will be allocated only if return on investment is favorable), for example.

- *What resources are required to deliver the instruction in its current format and what are the current costs?*

  Consider all categories of resources to include instructor and student personnel costs, and other direct and indirect costs. The next section on cost analysis lists the primary resource categories.

- *Is the technical infrastructure in place to support the implementation of the project?*

  Determine if instructional systems are available for the development and delivery of IT courseware. Will students have adequate access to the system? If it is feasible to use more than one media for a project, select the one that has a robust infrastructure already in place; or be prepared to fund and perhaps build, the required architecture.

Continued on the next page

Infrastructure and Resource Feasibility Analysis (continued)

Infrastructure and Resource Issues (continued)

- *Is the organizational, administrative, and technical support structure adequate to ensure successful implementation of the project?*

  This is usually not a big problem if the project involves technology insertion in the resident program but may be very problematic in the DL environment. Includes everything from a consideration of student registration procedures to DL site personnel who will help facilitate the project in the field. (See section D, Chapter 2).

- *Is manpower available and trained to perform all ISD functions and to successfully field the project?*

  Includes instructors and facilitators, administration support personnel, students at anticipated remote site, and the IT core team and development team.

- *Is commercial off the shelf (COTS) courseware available?*

  Always look for existing solutions to avoid duplication of effort.

- *Is Defense Technical Information Service (DITIS) or Defense Audio Visual Information Service (DAVIS) available?*

  These databases have an abundant amount of existing courseware.

- *Is funding available for in-house or contracted efforts?*

  Determine what the budget constraints are first.

- *What is the estimated length of time required to get resources and funding in place?*

  Compare this and the estimated development time for a given technology to the required operational date or estimated time of completion.

Next Step

If based on the answers to the above questions, you determine that conversions to certain instructional technologies is practical (you may have excluded some technologies due to lack of infrastructure), you should conduct a cost analysis to compare the cost of current instruction to other appropriate IT options and to estimate the overall cost of the project.

Section E

Comparative Cost Analysis

Overview

Before making a final selection of instructional media, it is important to determine if the potential benefits accrued by distance learning or technology insertion outweigh the potential costs, or whether the instruction will be cost-effective and provide an acceptable Return On Investment (ROI).

The purpose of a cost analysis is to provide the necessary information to facilitate and improve the evaluation and decision-making processes. Therefore, it is important that an accurate and comprehensive analysis of cost/benefit data be accomplished. This section provides:

- An overview of the concepts involved in cost analysis.
- The typical cost and benefit factors considered in the analysis.
- A general approach for selecting or developing an appropriate cost model.

There are automated cost analysis tools available that can be used to assist decision-makers. Refer to the AFDLO Web site (*http://www.au.af.mil/afdlo*) for the most current cost analysis information and references.

Basic Cost Analysis Approaches

The focus of the cost analysis and the basic approach taken will depend on what you intend to assess. If you are assessing whether training is working, or if training solves a problem, then you must assess the outcomes. If you are assessing how to reduce training costs, or the most efficient way to conduct training, then you must assess elements other than outcomes. The two general types of cost analyses are:

- **Cost/benefit analysis.** Cost/benefit analysis is used when decision-makers need to understand the full impact of an alternative, not only the financial costs of the alternative, but also qualitative costs and benefits. This approach to decision-making is used when the objective is to select that instructional alternative which presents the "best value" – and this may result in the selection of other than the lowest cost alternative. When comparing alternative approaches to training, a cost/benefit analysis is often performed for each alternative and then the results are compared.
- **Cost-effectiveness analysis.** This analysis is used when cost is the major decision factor. Compares the costs of two or more training alternatives to determine whether the selected medium can reduce costs, or is the most efficient method of instruction. For instance, does a move to interactive media training save time and money?

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Comparative Cost Analysis (continued)

Cost Modeling Definition

Effective cost analysis relies on the implementation of carefully constructed financial models of training. A model defines:

- The variables involved in calculating the cost of training.
- The relationship of those variables to one another.
- The assumptions being made.

Variables might include labor, materials, equipment, facilities, and travel expenses.

A model places the variables in an equation to represent training costs. For example:

TC = L + M + E + F + T

Where (TC) training costs are the sum of the (L) labor, (M) materials, (E) equipment, (F) facilities, and (T) travel.

A model dictates what data is to be collected. That is, it determines what costs are to be measured.

Continued on the next page

Comparative Cost Analysis (continued)

Cost Factors

A valid cost analysis must be complete. All costs involved in all aspects of design, development, evaluation, and implementation of the training must be included. Both the one-time "start-up" costs and recurring operational costs need to be considered in the analysis. Thus, the first step in conducting any type of cost analysis is to identify all the costs that must be defined (figuring out the actual costs for each cost category comes next). When determining the cost categories, remember that these costs will have to be defined for each alternative being analyzed. The typical cost factors include:

- **Hardware and Software Costs:** computer systems, production equipment, training equipment, programming and application software, etc.
- **Network/Telecommunications Costs:** telecommunications costs/fees as applicable to include access/user costs for satellite and terrestrial networks.
- **Instructional Material Costs:** purchase, production, and distribution costs for courseware and other instructional materials.
- **Personnel Costs:** manpower costs for instructors, facilitators, instructional developers, programmers, technicians, maintainers, administrators, participant's time spent in training, etc., as applicable.
- **Maintenance Costs:** repair, upgrade, and replacement of equipment, and the revision and maintenance of courseware.
- **Travel and Per Diem Costs:** travel to/from the schoolhouse or training site.
- **Other Support Costs:** administrative, contract, overhead, facilities, etc.
- **Training Attendance Costs:** participant's time spent in training; lost productivity or cost of replacing the individual while in training.
- **Instructor Costs:** Instructor's time spent in training; lost productivity or cost of replacing the individual while in training.
- **Other Instructional Development Costs:** Non-personnel resources used during the design and development of the training materials.
- **Course Metrics:** Expected course life; course length; number of students in each class; number of times the course is to be presented; number of instructors per class
- **Others:** Opportunity costs (lost sales); production and materials cost; development and evaluation time.

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Comparative Cost Analysis (continued)

Benefits

Measuring the direct benefits or results of the instruction is a more complex task since some benefits may be difficult to quantify. The objective is to attach a cost or quantitative value to each benefit – and each benefit must be derived from the instructional alternative being examined. That is, there may be other factors that contribute to a given benefit; the analyst must isolate and measure only the effects of training. Typical benefits to consider include:

- **Reduced training time:** Reductions may be realized in facility, personnel, and TDY costs, as well as less nonproductive/lost time while student is in training.
- **Reduced material costs:** Potential cost savings for revision, distribution, and maintenance of instructional materials/courseware in electronic format versus printed or "hard copy" materials.
- **Improved on-the-job safety**: Translates into fewer accidents and increased productivity.
- **Improved job performance:** Less time to perform/accomplish tasks, increased productivity/efficiency/quality of work, or improved management/command/supervision/decision-making ability, amount of positive versus negative feedback from "clients", changes in employee morale and motivation.
- **Reduced manpower requirements:** Potential manpower savings as a result of increased efficiency or productivity, less supervision required, etc.
- **Reduced equipment requirement:** Simulation training may reduce the need, impact, or expense of allocating actual equipment to train hands-on skills.
- **Higher equipment operational availability:** Fewer operator/maintainer errors, safety incidents/accidents, etc., may result in lower maintenance requirements and equipment/system downtime.

Cost/Benefit Models

There are many different types of cost/benefit models available, from basic models, to very specific models tailored for a particular type of training situation. The choice of the model is dictated by the purpose of the assessment. Three of the most common types of general cost models are:

- Resource requirements model (additive model)
- Life cycle model
- ROI model

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Comparative Cost Analysis (continued)

Resource Requirements Model

In general, the resource requirements model identifies the associated costs over a specified time period. This type of model (see example below) can be used to sum up the costs of a particular instructional system during the various phases of development for comparison with the costs of using other instructional media. One matrix is developed for each medium or approach being considered. The matrices are compared and provide data to support selection of one alternative.

Phase	HW/SW Costs	Network Costs	Material Costs	Personnel Costs	Maintenance Costs	Travel Costs	Other Costs
Analysis							
Design							
Development							
Implementation							
Evaluation							
Totals							

Life Cycle Model

The life cycle cost model identifies the cost of the instructional system over its useful life. This type of model looks at the initial start-up costs for implementation and the recurring costs of a particular instructional system based on the projected life cycle. The initial start-up costs for technology-based instructional systems are generally high as compared to the traditional classroom lecture costs. However, when these initial costs are amortized (start-up cost spread over the number of life cycle years) and combined with the lower recurring costs, the actual operating cost over the life cycle period is usually much less, particularly when calculated as cost per student. That is, as the number of students trained increases, the cost of training each student decreases. The following diagram demonstrates this principle.

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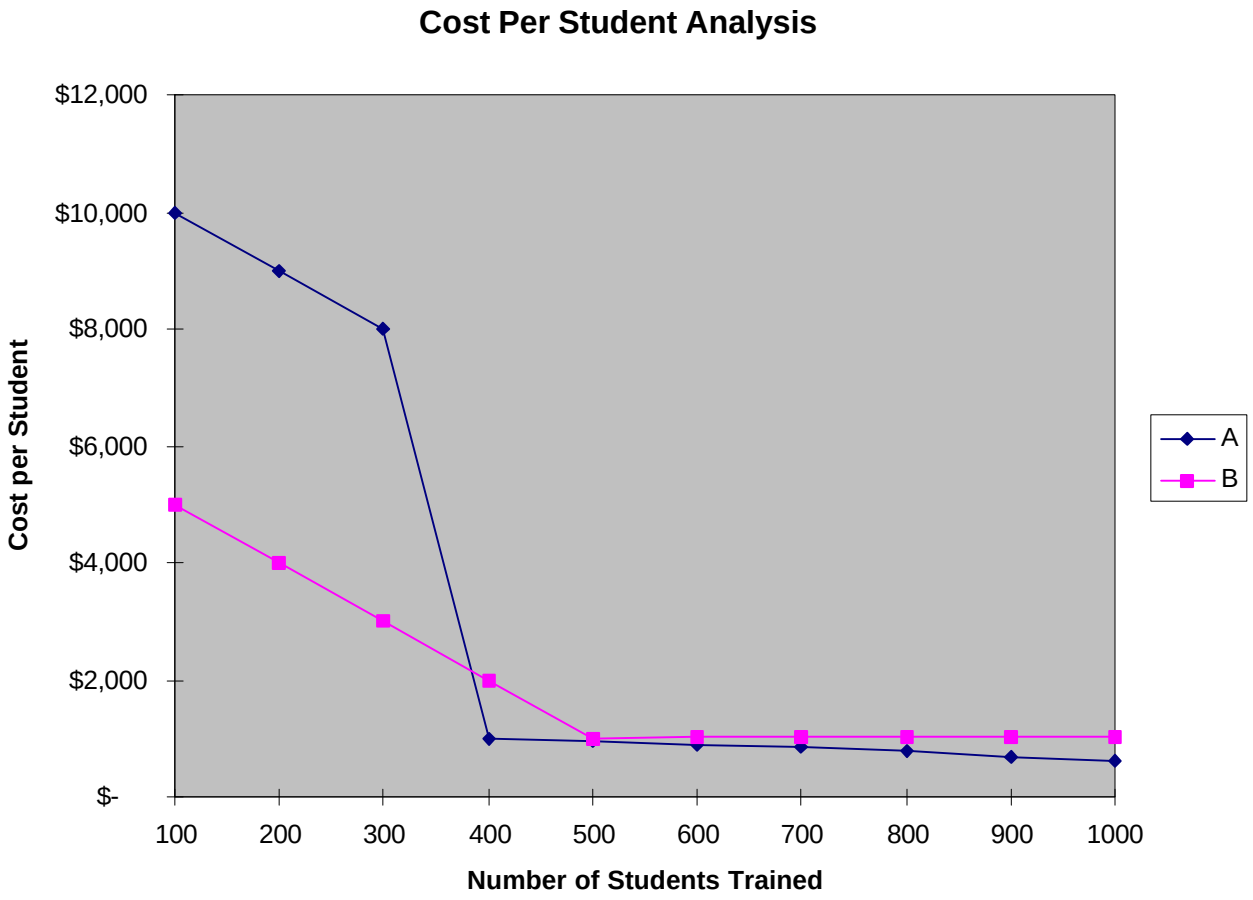
Comparative Cost Analysis (continued)

Life Cycle Cost of Instructional Programs

In the following diagram, "A" represents a small technology-based instructional program while "B" represents the same program developed as a traditional lecture-based resident instructional program. In this case, we are looking at the cost per student. At about 380 students, the cost per student is the same for each alternative. After that point, the cost of alternative "A" is less per student. Cost savings are realized by introducing technology if more than 380 students are to be trained.



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Comparative Cost Analysis (continued)

Return of Investment (ROI) Model

The ROI model addresses the effectiveness of the instructional system in terms of a ratio of benefits versus costs. The ROI model could be applied for various instructional systems to determine the media with the highest ROI. For example if:

ROI = (value of benefits – cost of instruction) / cost of instruction

When comparing one system with a determined value of benefits of $2,000 and a cost of $500, and another system with a value of $1,500 and a cost of $1,000, the corresponding ROIs would be as follows:

(1) ROI: (2000 – 500) / 500 = 3

(2) ROI: (3000 – 1500) / 1500 = 1

In this example, system (1) is more cost-effective.

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Comparative Cost Analysis (continued)

Conducting the Cost Analysis

The general steps associated with conducting a cost analysis are depicted in the diagram below. Although it shows a linear series of steps, the actual analysis process may very well end up to be an iterative, ongoing process – many of the steps are performed concurrently and feed into one another as the application of processes and estimation techniques are refined. Teamwork is essential to effective cost analysis – the more expertise there is when estimating costs and benefits, the better the chances of establishing realistic cost comparisons.

Conducting the Cost Analysis (continued)

Step 1. Determine the type of analysis to be conducted – what kind of results expected? (Refer to AFDLO website for cost analysis guidance.)

- Cost/Benefit – compare and contrast costs and benefits of proposed alternative approaches to training.
- Cost-effectiveness – cost comparison of alternative systems/media.

Step 2. Identify cost factors and benefits or results that will be measured.

Determine what it is that you want to measure – what factors do you want to compare? Consider the availability of the information for each system/medium considered and document assumptions made.

Step 3. Select/develop appropriate model that will provide the desired results.

- Resource requirements model
- Life cycle model
- ROI model
- Other model(s)

Step 4. Collect data and ensure data is valid.

This can be the most time consuming part of the cost analysis process.
If you are comparing the cost of instructor-led resident instruction to the cost of technology-based instruction, make sure you understand what is included in the cost figures maintained for resident instruction. Know what is meant by cost per student day, or cost per graduate, etc. For example, are the cost of facilities and manpower included in these cost figures? Be sure you compare the same cost factors and DOCUMENT ALL ASSUMPTIONS.

Step 5. Apply data to the model.

Step 6. Determine and assess the results.

Section E

Media Selection

Overview

After a Media Feasibility Analysis, Infrastructure/Resource Feasibility Analysis and Cost Analysis have been accomplished, perform a reality check on the media selected, and make a final media selection/recommendation.

Issues

- Cost and learning effective media selection requires a formal decision process. Refer to Chapter 2 for information on the project management process.

The personnel required to accomplish a Media Feasibility Analysis are not the same as the personnel required to accomplish a Cost Analysis. Refer to Chapter 2 for information on team composition and coordination with other organizations.

- Final media selection occurs only after a Media Feasibility Analysis, Infrastructure/Resource Feasibility Analysis and a Cost Analysis have been accomplished.
- The final decision to convert a course or a module of instruction to an IT format is made by the course or training manager (or primary customer) based upon the results of the analyses and the recommendation of the instructional designer or project manager.

Next Steps

The Project Manager/Instructional Designer documents and reports findings to the primary customer. If the decision is made to proceed with in-house development, the Instructional Technology development team is assigned and a Memorandum of Agreement (MOA) or a project plan is negotiated with the customer according to the process described in Chapter 2. At this point, the IT development team will update DITIS/DAVIS database if appropriate to the selected medium, and initiate the project folder along with man-hour data collection and life-cycle management.

Front-End Analysis

Developing courseware requires a front-end analysis tailored to the chosen instructional technology. Chapters 5-9 describe some of the analysis issues pertinent to each media. A highly effective tool for conducting a front-end analysis for computer-based media is AL-TP-1991-0048, entitled "Characterization of Air Force Training and Computer-Based Training Systems," from Armstrong Laboratory, Brooks AFB, TX.