ARTICLES

Learning Interactive Videodisc Development: A Case Study
Stephen M. Alessi 2

Electronic Authoring and Delivery of Technical Information
J. Peter Kincaid, Richard Braby, and John E. Mears 8

Using Needs Assessment Data to Design a Graduate Instructional Development Program
David H. Jonassen 14

The Instructional Designer-Subject Specialist Relationship: Implications for Professional Training
Gary R. Morrison 24

Subject Specialist Consultation in Instructional Design: Higher Education
Martin Tessmer 29

Working with Subject Specialists: A Commentary on Morrison and Tessmer
Walter Dick 37

DEPARTMENTS

Book Reviews, edited by Allison Rossett

Course Design for University Lecturers by Allen H. Miller
Reviewed by David Owens 40

Essentials of Learning for Instruction by Robert M. Gagné and Mercy Perkins Driscoll
Reviewed by Lou Ann S. Dickson 41

ERIC Reports on ID, edited by Elena D. Beattie 43
Learning Interactive Videodisc Development: A Case Study

Stephen M. Alessi
Division of Psychological and Quantitative Foundations
University of Iowa
Iowa City, IA 52242

Abstract. This article describes the development of an interactive videodisc in a graduate course. Design of interactive video and instruction about interactive video are discussed.

Introduction

Interactive videodisc is fast becoming an important medium for instruction. The growing need for instructional design programs to train professionals in interactive videodisc development has been stressed by Allen and Erickson (1986), who also described a graduate course in which students obtain interactive videodisc development experience.

This article describes a graduate student interactive videodisc development project. The project is described both qualitatively and quantitatively for two purposes: (1) to make recommendations concerning interactive videodisc production, and (2) to make recommendations for teaching graduate students in Educational Technology programs how to develop interactive videodisc instruction.

The Program

During the 1985-86 academic year, five students in a graduate course on interactive video design and production developed an interactive videodisc for the University of Iowa College of Education. The college provided a $3000 budget for the production of a "kiosk" type informational videodisc with both a level 2 program and a level 3 program. The level 2 program is stored directly on the videodisc and controls the videodisc player without an external computer. The level 3 program is stored in an external computer which provides more flexible control of the videodisc player. In addition, computer text and graphics can be displayed with the prerecorded audio and video material on the videodisc.

The College of Education videodisc contains interviews of chairpersons from each of the departments in the college. It also contains scenes of faculty, staff, and students in the various departments teaching, doing research, and using college resources. It is a 30-minute videodisc with 274 minutes of motion video, 95 different still-frame images, and an additional 15 minutes of audio on the second audio track.

Participants and Facilities

The students who participated in the videodisc development project had experience in educational television production and computer-based instruction design, but they had never produced an interactive videodisc program. Project guidance was provided by an instructor and others with interactive video experience. The instructor assisted the students in refining program goals and reviewing products; however, the students were given considerable latitude in making design and production decisions. The College television studio had the equipment needed to produce the original videotape for the program, with the exception of that required for still-frame editing and duplicating onto a one-inch videotape master.

Procedures

Phases of Development

The instructional development model used in the project was based on Wright's (1984) task analysis, with additional considerations from Luppata (1984), Floyd and Floyd (1982), DeBlois (1982), Daynes and Butler (1984), and Alessi and Troglin (1985). The major phases of the model were: (1) planning, which included analysis of needs and possible solutions; (2) instructional design, which included production of scripts and flowcharts; (3) production, which included parallel preparation of audio and video, computer programs, and documentation, and (4) evaluation, which included review, pilot testing, and some revision of the computer programs and documentation.

Data Collection

Students were required to maintain time and expense logs of all their project activities. Each entry included the date, the time spent, the expenses incurred, the persons involved, and a description of the activities completed.

JOURNAL OF INSTRUCTIONAL DEVELOPMENT
The student logs were the basis for calculating the development time for various project activities. Students were required to record activity data at the time they engaged in any activity. Additionally, logs were checked periodically by the instructor to ensure that they were accurate and up to date. Logs of different students were cross-checked to further ensure the accuracy and validity of the data.

Design and Development of the Program

Planning. Planning included allocation of project tasks, determination of the project timeline (Figures 1 and 2), selection of equipment and computer programs, formulations of program goals, discussion of clients' expectations, and meeting with people to be videotaped.

Instructional Design. The major activities in the design phase were script writing and flow chart preparation. A computerized script-writing program was used to produce a scripted storyboard. The scripts specified all video, computer display, audio, and program branching. Two scripts were developed, one for the Level 2 program and one for the Level 3 program.

Program flow charts were also produced. The flow charts depict the general structure and sequence of the Level 2 and Level 3 programs. Although scripts provide a detailed delineation of branching that is particularly useful for programming, flow charts provide a graphic summary which is especially useful during planning and evaluation.

Video Production. Some students produced the video segments for the videotape at the same time that others produced the computer programs that control the videotape player. Video segments were recorded in faculty offices, university classrooms and laboratories, elementary and secondary school classrooms, and in other college facilities. All recording was done on three-quarter-inch videotape. Approximately 20 hours of unedited footage was recorded. Unedited video footage was shown for approval to clients and the people recorded and some footage was rerecorded. A detailed edit was done on paper indicating what source material would be edited to exactly which sections of the master videotape.

The 30-minute master videotape was assembled from many sources: audio-tape, slides, videotapes, 16mm motion pictures, a character generator for text and graphics, and a video switcher for special effects and titles. Still images, such as slides, were inserted at multiple locations to facilitate quick access on the videotape.

Programming and Documentation. Level 3 programming was done in the BASIC programming language, with calls to machine language for computer text and graphics and for control of the videotape player.

The Level 2 program was developed using an assembler which converts source code to machine language object code, downloads it to a videotape player, and generates printouts appropriate for the production of a Level 2 program.

Both computer programs were tested extensively with an existing commercial videotape. That is, the computer programs were tested with the presentation equipment but using an existing videotape in order to assess the accuracy and speed of frame searches, the overlaying of computer text and graphics on the video display, and user control of the program.

A user manual was produced with directions for setting up the presentation equipment, starting the program, and controlling the program using either the videotape player's hand controller (for Level 2) or the computer keyboard (for Level 3). Emphasis was on keys to press to begin the program, to freeze and resume action, to return to menus, to select program sections, to get help, and to exit.

Mastering and Evaluation. A check disc was obtained and reviewed. A log designating the exact frame numbers of still frames and the beginning and ending frame numbers of action segments was prepared. The log was used to finalize and test the computer programs. The check disc was also inspected for video and audio quality. Minor errors such as poor edits were found, but did not merit remaking the master tape. After the Level 2 program was thoroughly tested, its printout was sent to the videotape production facility along with directions for videotape duplication.

Videodisc production required three weeks. Each student was assigned to assess a different aspect of the program on all videodisc copies produced: audio quality, video quality, the Level 2 program, and the Level 3 program. Some discs were returned and replaced due to audio or video defects.

The Level 2 and Level 3 programs were pilot tested with users unfamiliar with the videodisc. Feedback concerning the Level 3 program was used to modify it. Since the Level 2 program could not be changed without remaking the disc, problems found in it, primarily unclear directions for use, were corrected by modifying the user manual.

1988, VOL. 11, NO. 2
Figure 1. First semester project time-line.

Figure 2. Second semester project time-line.
Results

Design and Development Time

Analysis of the student's time and expense logs indicated that a total of 1579 person-hours were needed to design, produce, and evaluate the finished videodisc programs. The percentage of total project time devoted to each development phase is shown in Figure 3.

Planning required approximately 92 hours, or 6 percent of the total project time. The scripts totaled 346 pages for the Level 3 program and 230 pages for Level 2. Scripting required 416 hours and flow chart preparation 28 hours. Including miscellaneous activities, instructional design required 472 hours, or 30 percent of the total project time. Audio/video production took 262 hours, photography 9 hours, and editing 209 hours for a total of 474 hours, or 30 percent of the total project time. Level 3 programming required 329 hours, Level 2 programming 78 hours, and documentation 38 hours, for a total of 445 hours, or 28 percent of project time. Review and evaluation required 96 hours, or 6 percent of total project time.

The reader should compare this to the conventional wisdom for development of standard computer-based instruction, which varies from 100 to 500 development hours per hour of presentation time. The presentation time for this program, combining both the Level 2 and Level 3 versions, is about 50 minutes. This project, therefore, represented about 1000 development hours per hour of presentation.

Cost

Expenses and activity times for the project are shown in the first three columns of Table 1. Because the majority of personnel were graduate students, no actual costs were incurred for their labor. But for most projects, all activities and facilities have associated costs. Based upon a rate of $40 per hour for video design and production, the fourth column shows potential expenses had commercial services been purchased. The actual costs incurred producing the program were $2542. Commercial services would have added an estimated $63,160. Professional services might, however, accomplish tasks in less time. Cost will vary widely, depending on the specifics of a particular project.

Successes and Shortcomings

Overall, the program met the clients' expectations of clarity, ease of use, and content accuracy. There was some dissatisfaction with repeated use of some spokespersons in the program and with incongruities between the persons shown in the program and the departments being described.

These shortcomings were due primarily to a lack of design detail in the scripts. For example, names of the persons seen in accompanying visuals were not always specified, so redundancy was not caught early. As another example, the students with standard video production experience argued against detailed scripts of interviews, insisting an interview is under control of the person being interviewed and cannot be scripted word for word.

The class was allowed more leeway in the aspects of design than was perhaps wise. Students, especially those with previous video production experience, must learn the different requirements for scripting an interactive videodisc. Even interviews must be carefully scripted because of the exact
TABLE 1

Activities, expenses, times, and estimated expenses.

<table>
<thead>
<tr>
<th>Activity or Service</th>
<th>Actual Expenses Incurred</th>
<th>Actual Person Hours</th>
<th>Estimated Additional Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>92</td>
<td>3,680</td>
<td></td>
</tr>
<tr>
<td>Instructional design</td>
<td>472</td>
<td>18,880</td>
<td></td>
</tr>
<tr>
<td>Audio/video production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilities and personnel</td>
<td>474</td>
<td>18,960</td>
<td></td>
</tr>
<tr>
<td>Video tape</td>
<td>230</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Narrator</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Film and processing</td>
<td>111</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dub/edit 1 inch tape</td>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programming and documentation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 3</td>
<td>329</td>
<td>13,160</td>
<td></td>
</tr>
<tr>
<td>Level 2</td>
<td>78</td>
<td>3,120</td>
<td></td>
</tr>
<tr>
<td>Manual and documentation</td>
<td>38</td>
<td>1,520</td>
<td></td>
</tr>
<tr>
<td>Review and evaluation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilities and personnel</td>
<td>96</td>
<td>3,840</td>
<td></td>
</tr>
<tr>
<td>Check disc</td>
<td>375</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mastering</td>
<td>1,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seven disc copies</td>
<td>126</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>$2,542</strong></td>
<td><strong>1,579</strong></td>
<td><strong>$63,160</strong></td>
</tr>
</tbody>
</table>

30-minute limitation of disc space. Audio and video fades or other scene changes must be exactly described and of precise length to capitalize upon the random access capability of videodiscs. The required precision can be accomplished by an iterative process of initial planning, review or rehearsal, and revision. For example, a draft script may loosely specify the content of an interview. After a "rehearsal" interview, the script may be revised to permit precise timing and selection of accompanying visuals. The final interview may then be practiced and recorded.

In a professional project, client concerns should be detected early in the design process. Although the clients approved portions of the video and narrative material at an early stage, the students failed to have them review a draft of everything. At one point the director of the television studio and the instructor did review everything and noted the talent redundancy problem. Revision was not demanded due to a tight time schedule and because it was a student project.

Some of these problems were also due to recording in natural field situations, such as elementary schools, where little control can be exercised over what occurs. Although 20 hours of videotape was recorded, this was too little for quality video of sufficient variety for a 30-minute presentation.

Discussion

What Should Be Done Differently?

The problems described above, and some others, could be eliminated by thorough adherence to the following guidelines. These are things especially likely to be overlooked by novices to instructional design.

Scripting. Interactive video requires much more detailed scripting than linear video. Synchronization of video, narration, and computer displays must be precisely described.

Video Production. Shooting must follow the script very carefully and be coordinated with computer text and graphics. Time must be allowed for reshooting. Video intensity, color saturation, and audio levels must be planned and kept uniform. A detailed paper-edit is necessary before on-line editing occurs.

Editing Equipment. Still frame production with standard videotape editors is unsatisfactory. Equipment is recommended which stores still frames in memory and transfers them at 30 frames per second to the master videotape.

Computer Programming. A severe problem in Level 3 programs is synchronization of video and computer images. Synchronization should not be based on either timing loops or the computer's internal clock, due to variations between computer speeds and videodisc player speeds. The most reliable synchronization method is for the computer to read the videodisc player status and frame numbers. Hence, videodisc players not capable of returning frame numbers to the computer should not be used for Level 3 programs.

Selection of Hardware and Software After Design. Many developers of interactive videodisc programs assume that overlaying—the simultaneous display...
... it is suggested that learning to produce an interactive videodisc may not be best accomplished in a *first course* on interactive video. ...
Electronic Authoring and Delivery of Technical Information

J. Peter Kincaid  
U.S. Army Research Institute for the Behavioral and Social Sciences  
Orlando, Florida  
and  
Richard Braby and John E. Mears  
Eagle Technology  
Orlando, Florida

Abstract. Current developments in automating the processes to author technical information and deliver it using microcomputers are described in this article. The Department of Defense (DoD) has directed that the entire logistics support system (including technical information now contained in printed manuals) be computer-based for new major systems entering production during the 1990s. Addressed are issues relating to authoring efficiency, information access, user acceptance, and screen formats. The article also reviews several ongoing projects and discusses implications for making the transition from paper to computer-based technical manuals.

If current Department of Defense (DoD) policy is implemented as planned, within the next ten years most technical manuals used by the military service will be "paperless." Technical information, now mainly in paper form, will be presented on computers, with all the advantages and problems to be overcome that this technology entails.

While this article is primarily concerned with the automation of technical information, it should be noted that a computer logistic support system is envisioned as a comprehensive tool, integrating the automated processes to create, store, retrieve, use, and exchange weapons system procurement and support data.

Two major goals of this DoD program specifically relating to technical information are to:
1. accelerate the automation of contractor processes for generating logistic products such as technical manuals and training materials.
2. rapidly increase U.S. military capabilities to receive, distribute, and use technical information in digital form to improve weapons system maintenance and training.

Much development needs to occur in the next few years to accomplish these ambitious and worthwhile goals. This article describes some of the programs to date as well as problems, research, and management issues which must be addressed over the next several years.

Problems with Traditional Technical Manuals

The volume and cost of technical manuals used by the U.S. military forces has grown exponentially in the past 40 years. Whereas a World War II fighter aircraft required just a few technical manuals, a current weapons system may require over 100 separate volumes (Natura, 1985). This increase in technical data, typical of most major U.S. weapons systems, has burdened the user. It is commonly stated that it takes "six foot lockers to hold the technical manuals for the M1 tank." Maintenance technicians frequently need several manuals to perform troubleshooting and repair tasks. More often than not, checklists for a particu-

All three U.S. military services are involved in projects to automate the authoring and display of technical information.
lar troubleshooting task have multiple references, sometimes contained in several volumes. As equipment is modified, technical information updates are slow to reach users in the field, and correcting technical manuals with update sheets is so awkward and time-consuming that it is frequently not done correctly. It is not surprising that technicians do not always consult the manuals when they should.

The documentation problem is compounded by a potential shortage of highly skilled technicians, and demographic figures offer little encouragement. The birth rate in the United States fell considerably about 18 years ago, which will soon result in an insufficient manpower pool for recruiting. Skilled technicians will be in short supply throughout the remainder of this century.

Another problem with traditional technical manuals is that they are composed mostly of text and contain a minimum of graphics. An exception is the U.S. Army's New Look manuals, which have been well accepted by their users but are expensive to produce.

This dual problem of difficult-to-use documentation and a lack of adequate numbers of skilled technicians results in maintenance errors of four types, according to Inaba (1985):

1. unnecessary removal of good parts,
2. failure to isolate reported problems,
3. damage to equipment, and
4. process errors which do not damage the equipment but take excessive time to correct.


All three U.S. military services are involved in projects to automate the authoring and display of technical information supporting weapons systems, such as technical manuals, job performance aids, computer-based technical training materials, and automated diagnostics. In addition, many major U.S. defense contractors are working on such projects. A brief listing of several projects follows. A more thorough description of several military programs may be found in Johnson and Smillie (1987).

While EIDS is designed primarily as a training device, it almost certainly will also be used as a paperless technical manual.

Naval Technical Information Presentation System (NTIPS)

NTIPS is a system consisting of a family of delivery devices and an authoring system which is being designed as an integral part of the Navy's logistic support system. Its goals are to:

1. present comprehensible, high-quality technical information to enlisted technicians for all types of maintenance and operation functions,
2. present training information to achieve, maintain, and advance technical competency in shore schools and aboard ship, and
3. communicate with centralized and administrative functions for the consolidation of reports and logistical actions.

Two NTIPS field studies have recently been completed, one on an avionics subsystem of the F-14A aircraft and another on the SPA-25 radar repeater, which compare electronic delivery of technical information with printed manuals. Both experienced and inexperienced technicians did better using electronically delivered job aids and preferred their use (Fuller & Post, 1987).

Electronic Maintenance Publication System (EMPS)

EMPS is a system combining a videodisc and microcomputer developed by the U.S. Army Missile Command (MICOM) at Redstone Arsenal. EMPS has been field tested at Fort Bliss, Texas, with a data base taken from over 1000 pages of technical manuals used to maintain the Patriot missile. The Production Management System...
The manner in which procedures are organized and presented . . . affects both learning time and subsequent job performance. . . .

Militarized Electronic Information Delivery System (MEIDS)

MEIDS is a portable electronic device which will largely replace the technical manuals that Army technicians use in the field. The configuration for the device is still being formulated, but it will be rugged, portable, and will use an expert system for indexing and accessing data stored in its data bases. The final design of MEIDS will benefit from the field tests of PEAM and EMPs. For example, the PEAM field test has contributed to the initial functional specifications for the MEIDS program.

Integrated Maintenance Information Systems (IMIS)

The Air Force Human Resources Laboratory is developing IMIS (Collins, 1985). The system will integrate computerized maintenance data bases with an automated technical data system, and will include diagnostic job aids to increase the ability of technicians to perform fault isolation. It will be an integrated approach to total weapons systems maintenance, linking technical data and information about training, diagnoses, management, and scheduling. The authoring software for IMIS, the Authoring and Presentation System (APS), has been developed in-house. One of the important characteristics of APS is that it incorporates a relational data base approach, allowing the creation of display frames from data bases rather than requiring the authoring and storage of a massive number of individual frames. A second part of the project is concerned with electronic delivery of technical information, primarily job performance aids (JPAs). A field test completed last year used a portable, commercially available Grid microcomputer and showed the same kind of favorable results as did the PEAM, NTIPS, and EMPs field tests.

Design Considerations

The manner in which procedures are organized and presented to technicians, whether using paper or electronic devices, affects both learning time and subsequent job performance (Kincaid & Braby, 1987). While many questions still remain on how best to present procedural instructions electronically, progress is being achieved.

Booher (1975) proposed that pictures are effective in teaching location tasks, but that words must also be used to effectively teach complex procedures. Guidelines have recently been published for formatting procedural instructions (e.g., Braby, Hamel, & Smode, 1982; Braby, Kincaid, Scott, & McDaniel, 1982). These formats have proved to be highly effective in training procedures and in preparing trainees to use expensive simulator training devices.

User Acceptance

One special requirement will be for displays that enhance the technicians' skills as well as guide them through the steps of an operation. Job performance aids must be built so that they serve as training materials. In a report on the status and future of maintenance job aids (Chenzoff & Joyce, 1985), this requirement was addressed in presenting research issues for JPA development:

From a maintenance performance point of view, the sole purpose of an aid should be to wean the student away from needing the aid. . . . All further R&D in job aiding must be focused on facilitating skill development on-the-job. . . . Perhaps the most important factor that was ignored in the early JPA efforts was the need for the maintenance workers themselves. The "technicians" felt degraded since they were only qualified to perform the simplest tasks. They felt they were being "led by the hand" through a series of steps that had no meaning for them.

It was also indicated that job performance aids have to be provided in a form that will enable technicians to understand what is happening within a system, what conditions need to be met for the system to operate properly, and what symptoms are produced when system components fail.

Effective Display Formats

In developing effective computer-based technical manuals, lessons learned through long experience in designing and using paper technical manuals should be utilized. However, electronic displays which are merely facsimiles of paper pages are likely to be rejected by technicians, and would Underutilize the major capabilities of
the computer. Unlike paper displays, computer displays can be dynamic, information can be manipulated by users, and indexing and accessing can be automatic. Computer displays can be made to automatically change as changes take place in the conditions of a problem. The displays can adapt to the skill level of the technician by presenting information at different levels of detail. Disadvantages of current computer displays are that they have much poorer resolution and are smaller than printed materials.

Designing displays and organizing information for computer presentation involve developing techniques that respond to contingencies and special requirements of the user and can be understood given the limitations of the presentation.

A number of issues related to the use of job aids, whether presented on paper or in electronic form, affect job satisfaction. Ideally, electronically presented job aids should have the following characteristics:

- The level of explanation can be adjusted, for example, information explaining the reasons for each action can be added.
- The level of detail in the job aid can be adjusted, so that the job aid can present full procedures illustrating each small action, partial procedures, or a short checklist without illustrations.
- The technician can retrieve from the system just the information that is required, and can obtain additional information about any particular part of a procedure.

These points are illustrated by computer display screens from an ongoing research project sponsored by the Army Research Institute. The screens depict a single step in a maintenance procedure, the removal of a component from the Thermal Imaging System of the M1 tank. The step is presented at three levels of difficulty: for the novice who relies on a step-by-step presentation including illustrations (Figure 1, top), for the experienced but not yet expert technician (Figure 1, middle), and for the expert (Figure 1, bottom), who only needs a checklist, not highly illustrated and complete instructions. Graphics and text are similar to that in the technical manual, but the organization of the material was altered significantly for computer presentation.

Figure 1. The same maintenance information presented to a novice (top), a somewhat experienced technician (middle), and an expert technician (bottom).
Figure 2 depicts how the information is loaded into a computer data base. Although space limitations do not permit us to fully describe the advantages of the authoring procedure, several points are worth noting. The equipment consists of a Zenith 248 computer, which is compatible with the IBM PC/AT computer and which the DoD has purchased in large numbers; a device for loading existing art into the database by a process of raster scanning; and associated peripheral equipment such as a laser printer. Total equipment and software costs are about $12,000.

The programming language which produced these computer screens is called SMALLTALK. It is inexpensive, easy to modify, and is excellent at handling graphics. Our implementation of SMALLTALK provides for automatic cross-referencing, including graphics. Individual screens are created from separate components. For example, the screen shown at the top of Figure 1 was created from the line drawing, the text, and the arrows. It takes less than a second for it to appear on the screen. Individual screens are created "on the fly" from separate files so that the same graphic or string of text need only be stored once and can be used many times in different combinations.

Cost of Production

The high cost of producing printed job performance aids that include full procedures and illustrations, such as Army New Look manuals, has kept them from being widely used. The high cost of these materials is due to an increase in the number of pages required to support a given task and the more extensive use of expensive graphics.

There is the general expectation that computer-based job aids will be less expensive than paper job performance aids. However, computer-based job performance aids could prove to be even more costly if they are produced in the traditional way, frame by frame. Each electronic frame contains less information than an equivalent paper page, so a substantial increase in effort would be required to produce electronic frames in the place of paper pages. One estimate is that it will require 15 to 20 times more electronic frames than paper pages to present a given task in a job aid.

To be economical, an authoring system should be built on relational data bases from which individual frames can be constructed, and should use compaction techniques to minimize digital storage requirements. Both the PEAM and IMIS authoring systems have incorporated these concepts to varying degrees. For example, the authoring system for PEAM incorporates a number of features to compact both the storage of text and graphics. The authoring system for IMIS makes extensive use of elements of information retrieved from a relational data base to build a frame "on the fly," which reduces the need to store large numbers of individual frames. The project illustrated in the figures that accompany this article also includes a relational data base and builds frames "on the fly."

Figure 2. Screen demonstrating authoring of the three screens in Figure 1.

Conclusions

A major technical challenge, as articulated in this article, is to produce and demonstrate practical and useful authoring and delivery techniques for electronic technical information. To be most effective, efforts should: (1) build on previous and ongoing research and development initiatives, many of which were described here, (2) incorporate computer hardware and software developments from the com-
mercial sector, and (3) attend to issues of user acceptance. The development of display formats and techniques for organizing large amounts of information should be given high priority in future research.

References


Using Needs Assessment Data to Design a Graduate Instructional Development Program

David H. Jonassen
Instructional Technology Program
School of Education
University of Colorado at Denver
1200 Larimer Street, Box 106
Denver, CO 80224

Abstract. The role and function of corporate education and training is substantively different than that of public education. Therefore, the roles of corporate educators and trainers are different from the roles of public school educators. These differences have created a demand for preparation programs that are designed specifically to meet the needs of corporate trainers and designers. Preparation programs in instructional design and technology have attempted to meet that demand. In order to design such a program, the needs (or competencies) of corporate trainers and designers must be clarified. The needs assessment and curriculum design processes used to design a graduate instructional technology program to educate trainers and instructional developers for work in the corporate environment are described.

The Growth of Industrial Training

Significant growth of corporate training and instruction has occurred in the past two decades. Alongside colleges and the public schools, a new type of educational institution has evolved in the corporations of America. Training departments and even corporate colleges are supplementing and in some situations supplanting the professional preparation formerly available only at public and private universities.

The commitment of business to education and training has a variety of causes. Two prominent causes are the perceived decline in the efficacy of public schools and the increased specialization in job roles. Public school graduates often are not able to fulfill the increasingly demanding roles in our post-industrial society. The shift from an industrial to an information society has left many workers ill-prepared to assume new, information-dependent roles (Joffeur, 1979).

Corporations have had to supplement the educational preparation that their employees received in public schools and universities. This has resulted in the institutionalization of training departments and corporate colleges, which in turn has created the demand for corporate educators and trainers and precipitated the need for professional preparation programs. Educational technology and instructional design programs have increasingly attempted to fill that need.

Skills Needed by Corporate Trainers/Developers

In order to design an educational preparation program for corporate trainers and developers, the skills required of them need to be clarified. Other individuals have conducted needs assessments which have identified some general competencies. Deden-Parker (1981) queried the directors of industrial training organizations in the San Francisco area about the skills needed by corporate trainers. She identified 26 skills as being critical to the corporate trainer. Instructional design and production skills were found to be less important than interpersonal communication and management skills. Deden-Parker concluded from her study that corporate trainers had
significantly different educational needs than instructional technologists in public education. She recommended that corporate trainer/developer preparation programs require the use of corporate examples in their training as well as practical experience (internship) in corporate training environments.

Sullivan (1984) corroborated these results in a survey of 750 professionals from higher education and business. A total of 26 skills were identified from six prominent models of instructional design and development. The results showed that business trainers believed that most of the skills should be practiced more frequently than their counterparts in higher education, especially those skills related to assessing constraints, dealing with clients, differentiating needs, testing learners, and using performance-oriented evaluation.

Stolovitch (1981) summarized some of the differences between instructional development in education and in corporate training. Corporate training often must produce tangible cost benefits, whereas instructional development efforts in education are not as accountable. Time constraints are more important in industry than they are in education. Education is more concerned with the process, while industry is more concerned with the product. In industry, the instructional development model is more clearly defined and adhered to, whereas in education the process is often compromised. Education tends to focus on more general content, whereas industrial training is more specific and vocational.

The two most comprehensive needs assessments were undertaken by two important professional associations. The Association for Educational Communications and Technology (AECT) appointed a task force to develop a set of core competencies for instructional development professionals which could be used as standards for certification. The task force spent three years revising and perfecting the list (AECT Task Force, 1981). The competencies identified by the task force represent what they believe are the core competencies which should be possessed by instructional developers (not specifically trainers) in both business and education. This list has been updated and slightly expanded by the International Board of Standards for Training, Performance, and Instruction (1986), which hopes to become an independent certifying agency. The list represents perhaps the most definitive statement about instructional design and development competencies, but it does not adequately address many competencies that are needed by corporate trainers/developers.

Dedene-Parker (1981) and Sullivan (1984) both concluded that training programs for corporate trainers/developers should differ from those for instructional developers in educational institutions. In order to show the differences between competencies needed by educators and those needed by corporate trainers, the competency statements generated by the AECT task force were compared with the competency study conducted by the American Society for Training and Development, entitled Models for Excellence (ASTD, 1983). The ASTD membership and mission represent corporate training and development professionals more than do the AECT membership and mission. ASTD focuses more on human resources development, which includes many personnel and consultation functions not represented in the conceptualization of an instructional developer produced by the AECT task force, which has a narrower focus, specifically instructional design and development. Instructional developers and trainers in industry are expected to have a broader set of skills, which include many of the human resource development and organizational skills.

In Models for Excellence, 31 training and development competencies are identified. These competencies include many which are specific to the corporate training environment, such as adult learning, cost-benefit analysis, organization behavior, and personnel functions. However, the ASTD competency list does not include some instructional design skills, such as sequencing and evaluating instruction or determining instructional strategies. Some of these skills are implied by ASTD's more general competency statements, but they are not stated explicitly.

Because few individuals could possess all of the skills identified in Models for Excellence, the ASTD study identified 15 key training and development roles, such as instructor, manager, marketer, task analyst, theoretician, and transfer agent. Critical competencies were identified for each role, as were the outputs or products that represent competence. The human resources development orientation of ASTD members is reflected in most of those roles.

A comparison of the competency lists produced by AECT and ASTD reveals that the ASTD list has more "soft skills" (feedback skill, futuring skill, intellectual versatility), more generic information skills (library skills, research skills, writing skills), and consultation skills (questioning skills, human relations skills) than the AECT study includes. The orientation of the ASTD skills list differs from the AECT list, which focuses more on the instructional development job functions. The results of both surveys provide statements of important training and development competencies which can

Corporations have had to supplement the educational preparation that their employees received in public schools and universities.
it was important to identify the competencies which were most relevant to the local training community.

function as competency statements for designing a graduate curriculum.

Local Needs Assessment

In order to assess the competencies that were important to the local training community served by a graduate educational technology program, a local needs assessment was conducted. Since the AECT and ASTD surveys presented different models of corporate trainers and developers, it was important to identify the competencies which were most relevant to the local training community. The local needs assessment consisted of two parts: a critical incident analysis to generate important training and development skills, and a criticality rating of those skills that were identified by the analysis. The highly rated skills would confirm the competencies identified by the AECT and ASTD surveys and fill in any gaps in the combined list of competencies from those surveys.

Critical Incident Technique

The method selected for assessing needs was the critical incident technique. With this technique, reports or descriptions of behaviors that are normally exhibited by the target population are collected. The critical incident technique was developed by John Flannigan (1954, 1962) during the second world war as a means for discovering why some pilots were not learning to fly and what dimensions of combat leadership were necessary in the Army Air Corps.

Critical incidents are reports of observed behavior which are recorded and then analyzed to determine various performance dimensions of a task. The reports are observations, statements, or anecdotes by members of the population being analyzed (e.g., a police officer, salesman, or instructional developer), the individual’s supervisor, or the client or user of the individual's services. Anyone qualified to objectively observe and record the incidents that comprise an individual’s job may collect the critical incidents.

The critical incident technique has been used to analyze numerous types of jobs, including Navy recruiters (Borman, Dunnette, & Hough, 1976), police officers (Ronan, Talbert, & Mullet, 1977), and salesmen (Küchner & Dunnette, 1957). The method has also been used to develop general definitions or theories of professionalism in education (Leites, 1968) and leadership (Van Fleet, 1974). Its usefulness is general, and its effectiveness is well established. The reliability and content validity of the technique have been found to be good (Anderson & Nilsson, 1964; Ronan & Latham, 1974).

If the sample is representative, the observers sufficiently qualified, the types of observations appropriate, and the procedures capable of producing accurate reports, then the definition of a job using the critical incident technique is valid and comprehensive. After incidents are collected from qualified observers, including those who perform the job or task, the incidents must be analyzed.

Method

Needs Assessment Instruments

Data were collected through a critical incident survey, consisting of one page of directions that described the survey and the procedures for completing it, and a page for recording effective or ineffective incidents. The response page was used to describe a separate training or development incident observed by a respondent, the circumstances leading up to it, why the incident was detrimental or helpful, and the job title and experience level of the performer. This instrument was accompanied by a cover letter that described the background and purpose for the study.

A criticality survey was derived from the reported incidents. Each of the incidents was converted into a competency statement. The criticality survey asked the participants to rate the level of effectiveness and the level of importance of each competency statement to corporate trainers/developers on a 9-point Likert scale (very ineffective to very effective, very unimportant to very important).

Participants

The survey was mailed to a random sampling (100 members) of the local chapters of the National Society for Performance and Instruction and the American Society for Training and Development. All participants were either trainers or training supervisors.

Procedure

The critical incident survey was mailed to each participant. Two weeks after the initial mailing, 43 responses had been received. No follow-up mailing was undertaken because of time constraints. (The second part of the analysis had been scheduled, so the first part had to be completed.) The incident statements were condensed into competency statements which could be evaluated more effectively for their effectiveness and importance by the trainers.
During a scheduled meeting of the local chapter of the National Society for Performance and Instruction, 21 members other than the original respondents completed the criticality survey. This was followed by a discussion of the general competencies needed by trainers/developers in industry.

Results

Each of the 43 critical incident surveys was rewritten into a skill statement. Nonessential and contextual information was removed, leaving only a description of the skill. The skill statements are listed in Table 1. Since the critical incident technique asks for both effective and ineffective incidents, some of the skill statements do not represent effective training behavior. Each statement was evaluated for its effectiveness or ineffectiveness on the criticality survey.

The criticality survey ratings of the perceived effectiveness and importance of each of the skill statements derived from the critical incident survey are listed in Table 2. The mean levels of effectiveness and importance for each statement are presented. Those skills with a mean effectiveness and importance rating greater than 5 (on a 9-point scale) were identified and compared with the competencies in the AECT and ASTD surveys. Where competencies did not exist on the AECT and ASTD surveys to describe those activities, the incident statements were added to the final list of training competencies.

The skill statements from the local needs assessment were combined with the competencies listed in the ASTD and AECT studies. This final list of competencies (see Table 3) was the basis for designing the curriculum for a graduate program. The final list was assembled by starting with the AECT competency list and general headings, then eliminating competencies that were not mentioned on either the ASTD or local lists. Next, those competencies that were identified by ASTD and confirmed by the local study were added to the final list, along with additional general headings (e.g., "Provide Human Resource Development in an Organization"). Finally, additional skills that were identified by the local needs assessment and rated as important were added to the list.

| TABLE 1 |
| Statements of Critical Incidents |
| 1. Given a request for a workshop in a short time, developer performed a needs analysis and interviewed the client for examples and case studies. |
| 2. Developer suggested several ways to design the training (e.g., instructor led, simulation, etc.) |
| 3. Developed training which incorporated step-by-step job aids and steps to follow in lieu of training. |
| 4. In a trial run of recently revised course (by third party), developer made recommendations contrary to client's operational dictates. |
| 5. Before a group of retirement-age employees, developer did not analyze audience, so rambled and put audience to sleep. |
| 6. Developer did not fulfill customer's request by the negotiated commitment date. |
| 7. Training was developed even though course developer cited and documented environmental problems that caused performance problems. |
| 8. Developed training for a client even though it was not required to satisfy the client. |
| 9. Developer did front-end analysis, determining the tasks to be trained. |
| 10. Developer met with the client to determine exactly what the problem was. |
| 11. Developer prepared a clear cost analysis and reviewed it with the client. |
| 12. Developer negotiated a very clear contract of who would do what for whom. |
| 13. Trainer presented a concept training program without performance-based objectives. |
| 14. Trainer presented a program without analyzing audience. |
| 15. Teaching adults who are eager to learn because of immediate applications and very critical because of experience. |
| 16. Presented material in nontraditional ways, providing a good jolt to adults' conventional ideas about learning. |
| 17. Presented class activities that were appropriate, participative, skill-based. |
| 18. Prepared himself/herself in course content. |
| 19. Redesigned a concept program as a result of pilot program. |
| 20. Designed a workshop based upon instructional design modules that included performance-based objectives. |
| 21. While conducting an exercise, noticed that one student was having problems, so reassigned partners to place student with more understanding person, and increased contact with them. |
| 22. During the development of a new package, developer discovered several errors in the training materials provided by equipment producer. |
| 23. Presented information in a practical, jargon-free manner. |
| 24. Trainer brought own life experiences, to the classroom, especially those that were humorous, in order to make a point or illustrate a concept. |
| 25. Made a presentation that contained flash and excitement at expense of thorough, solid, helpful information. |
| 26. Purchased a program from a vendor without a good trial using a target population. |
| 27. Didn't prepare well for an upcoming class that had been taught before. |
| 28. Read verbatim from an Instructor's Guide during class. |

(Continued)
Table 1 Continued

29. Based upon error frequency on job, analyzed critical codes (job study) and
developed a job aid to address problem.
30. Developer depended solely upon SME input for information in develop-
ing the course.
31. Developer did not do an adequate data collection or task analysis to
determine the specifics of what should really be in the course.
32. Consultants reviewed evaluations and created a program to meet needs.
33. During a period of accelerated training, instructor refused to answer
several questions from students.
34. Developer neglected to properly analyze a specific task in order to develop
a training program.
35. Distinguished in terms of adult learners how cognitive/conceptual learn-
ing is different from process learning.
36. Designed specific, skill-related exercises to illustrate teaching concepts.
37. Selected appropriate off-the-shelf training material and adapted these
materials to their particular environments.
38. Provided effective training given the internal politics and culture of the
organization.
39. Assisted departments in developing their own training materials and
presentations.
40. Found out as much as possible about the organization in which he or she
works.
41. Developed a program based upon his/her perceived need without assess-
ing the needs of the user.
42. In a class, encouraged participants to share experiences and problems,
allowing the group to get involved in problem solving.
43. In a time management class, lectured constantly about too much infor-
mation without permitting practice or sharing of ideas.

If the competencies listed in Table 3 are used as the basis for developing
training programs for corporate trainers, the individuals completing such a
program should be better prepared to assume the role of corporate trainer
and developer. Ideally, a set of clinical experiences, beginning with observa-
tions and leading up through assistants and then to full-time training
employment would prepare students best, particularly those with no prior
business experience. However, these sorts of structured apprenticeships are
not cost-effective, neither to the corporation nor to the student. Instructional
programs must be redesigned to make the limited internships experiences as
meaningful as possible. A good deal of the corporate perspective can be gained
by the students if they are encouraged to join and actively participate in pro-
fessional associations such as ASTD and NSPI.

A curriculum was designed for a corporate training and development mas-
ters program to address the competencies stated in Table 3. The process of
developing the curriculum consisted of three stages: (1) determining program
requirements, (2) identifying existing courses in the university in which any
of the competencies were taught, and (3) designing courses to teach com-
petencies. Table 4 lists in the left column the courses in each curricular area
of the program.

The human resource development competencies were grouped together
to comprise a professional orientation core. Courses offered by the College of
Business and Economics as part of their Master of Business Education (MBA)
program were selected to fulfill the pro-

Training Programs for Corporate Trainers/Developers

Many educational media and instructional technology programs have
developed corporate training tracks or degree programs over the past decade
that are designed to prepare corporate trainers/developers. The conceptual
bases for these programs vary, as do their curricula. A number of programs are
providing corporate training seminars and/or internship experiences in
industry, such as those described by Dohen-Parker (1981). What graduates
often lack are the conceptual bases necessary to function in the corporate en-
vironment, both during their internship and their employment. Even though
there is no educational substitute for experience related to many of the
competencies listed in Table 3, we should attempt to prepare the students
as much as possible prior to internship or job experience. This is particularly
prevalent among the project management and monitoring competencies and the interpersonal and consulting behaviors.

What graduates often lack are the conceptual bases necessary to function in the corporate environment.
TABLE 2
Mean Effectiveness/Importance Ratings and Correlations

<table>
<thead>
<tr>
<th></th>
<th>Mean Effectiveness</th>
<th>Mean Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.58</td>
<td>7.28</td>
</tr>
<tr>
<td>2</td>
<td>5.63</td>
<td>6.94</td>
</tr>
<tr>
<td>3</td>
<td>6.90</td>
<td>7.37</td>
</tr>
<tr>
<td>4</td>
<td>4.05</td>
<td>6.61</td>
</tr>
<tr>
<td>5</td>
<td>1.50</td>
<td>7.20</td>
</tr>
<tr>
<td>6</td>
<td>3.05</td>
<td>6.20</td>
</tr>
<tr>
<td>7</td>
<td>3.26</td>
<td>5.95</td>
</tr>
<tr>
<td>8</td>
<td>3.63</td>
<td>4.56</td>
</tr>
<tr>
<td>9</td>
<td>8.25</td>
<td>8.35</td>
</tr>
<tr>
<td>10</td>
<td>8.05</td>
<td>8.45</td>
</tr>
<tr>
<td>11</td>
<td>6.84</td>
<td>7.15</td>
</tr>
<tr>
<td>12</td>
<td>7.65</td>
<td>7.55</td>
</tr>
<tr>
<td>13</td>
<td>2.37</td>
<td>6.21</td>
</tr>
<tr>
<td>14</td>
<td>1.45</td>
<td>6.85</td>
</tr>
<tr>
<td>15</td>
<td>5.69</td>
<td>6.63</td>
</tr>
<tr>
<td>16</td>
<td>6.50</td>
<td>6.65</td>
</tr>
<tr>
<td>17</td>
<td>8.21</td>
<td>8.32</td>
</tr>
<tr>
<td>18</td>
<td>7.75</td>
<td>7.85</td>
</tr>
<tr>
<td>19</td>
<td>7.89</td>
<td>7.89</td>
</tr>
<tr>
<td>20</td>
<td>8.21</td>
<td>8.11</td>
</tr>
<tr>
<td>21</td>
<td>7.45</td>
<td>7.50</td>
</tr>
<tr>
<td>22</td>
<td>6.76</td>
<td>7.35</td>
</tr>
<tr>
<td>23</td>
<td>7.63</td>
<td>7.94</td>
</tr>
<tr>
<td>24</td>
<td>7.32</td>
<td>6.79</td>
</tr>
<tr>
<td>25</td>
<td>2.83</td>
<td>3.67</td>
</tr>
<tr>
<td>26</td>
<td>2.17</td>
<td>3.50</td>
</tr>
<tr>
<td>27</td>
<td>2.83</td>
<td>3.31</td>
</tr>
<tr>
<td>28</td>
<td>1.25</td>
<td>2.85</td>
</tr>
<tr>
<td>29</td>
<td>7.62</td>
<td>2.62</td>
</tr>
<tr>
<td>30</td>
<td>3.27</td>
<td>3.77</td>
</tr>
<tr>
<td>31</td>
<td>1.77</td>
<td>2.77</td>
</tr>
<tr>
<td>32</td>
<td>7.75</td>
<td>3.25</td>
</tr>
<tr>
<td>33</td>
<td>2.17</td>
<td>3.42</td>
</tr>
<tr>
<td>34</td>
<td>2.25</td>
<td>2.67</td>
</tr>
<tr>
<td>35</td>
<td>6.91</td>
<td>3.55</td>
</tr>
<tr>
<td>36</td>
<td>8.09</td>
<td>3.36</td>
</tr>
<tr>
<td>37</td>
<td>6.93</td>
<td>4.44</td>
</tr>
<tr>
<td>38</td>
<td>7.60</td>
<td>5.01</td>
</tr>
<tr>
<td>39</td>
<td>6.93</td>
<td>5.06</td>
</tr>
<tr>
<td>40</td>
<td>7.40</td>
<td>4.88</td>
</tr>
<tr>
<td>41</td>
<td>1.73</td>
<td>3.69</td>
</tr>
<tr>
<td>42</td>
<td>7.33</td>
<td>4.56</td>
</tr>
<tr>
<td>43</td>
<td>1.53</td>
<td>3.13</td>
</tr>
</tbody>
</table>

TABLE 3
Amended List of Training/Instructonal Development Competencies

1. Identify Projects for Instruction or Training
1.1 Analyze information about projects and decide if instructional development is appropriate; conduct performance analysis.
1.2 Determine the cause of performance problems (personal, motivational, or environmental) and determine appropriate solutions.
1.3 Judge the appropriateness of projects selected and provide a rationale for the judgment.
1.4 Forecast trends and visualize possible futures in your organization and their implications for the operation of your organization.

2. Conduct Needs Assessments
2.1 Develop and conduct a needs assessment plan, including selecting appropriate techniques, instruments, question forms and question types.
2.2 Select tasks appropriate for analysis and instructional development.
2.3 Develop a range of information-gathering techniques (questionnaires, interviews, tests, observations) that captures needed information from people.

3. Assess Learner/Trainee Characteristics
3.1 Distinguish among entry skills assessment, prerequisite assessment and aptitude assessment.
3.2 Identify relevant learner/Trainee characteristics and determine methods for assessing them.
3.3 Develop and implement a plan for assessing learner/Trainee characteristics and the effects of those characteristics on learning performance.

4. Analyze the Job Task or Content
4.1 Identify knowledge and skill requirements of various tasks or roles and the components and sequence of the operations (mental or physical) needed to accomplish them.
4.2 Sequence learner outcomes and state a rationale for the sequence selected based upon task analysis criteria.
4.3 Classify task and content level of tasks and task components.

5. Write Performance Objectives
5.1 Distinguish objectives stated in performance terms from instructional goals, organizational goals, learner activities, teacher activities, and other statements.
5.2 Write complete and properly stated performance objectives.
5.3 Judge the accuracy, comprehensiveness and appropriateness of statements of learner outcomes in terms of the job, task, or content analysis or in terms of the opinions of the client or a subject matter expert.

6. Analyze the Learning Environment
6.1 Analyze characteristics of the instructional setting (environmental analysis) and determine instructional resources (media) that are appropriate to that setting.
6.2 Judge the accuracy, comprehensiveness, and appropriateness of an environmental analysis performed by someone else.

(Continued)
7. Select Instructional Strategies
7.1 Select instructional strategies and tactics (activities) that are appropriate for use with the types of learners, learner outcomes, and other criteria in your setting.

8. Sequence Instruction
8.1 Specify a sequence of learner activities which is appropriate to the achievement of specified learner outcomes, which is participative, and which actively engages the learner.
8.2 Judge the appropriateness and completeness of a given sequence of learner activities designed by another instructor.

9. Select Instructional Delivery System
9.1 Describe the instructional resources that are required to carry out instructional strategies and facilitate learner outcomes.
9.2 Evaluate existing instructional resources to determine their usefulness for supporting instructional strategies and learned outcomes.
9.3 Adapt and use existing instructional resources to fulfill instructional needs.
9.4 Plan for the production of materials by writing storyboards, lesson plans, script outlines, etc.

10. Evaluate Instructional Outcomes
10.1 Plan and conduct a formative evaluation (e.g., trials with subjects, expert review, analysis of implementation consideration, etc.)
10.2 Write criterion and norm referenced test items to evaluate learning outcomes and general abilities and prerequisite skills.
10.3 Revise materials based on evaluation feedback.
10.4 Evaluate formative evaluation plans, information-gathering techniques and revision specifications.
10.5 Conduct a cost-benefit analysis of training or instruction.

11. Manage Instruction/Training Efforts
11.1 Plan the components of a system for managing a course, training package, or workshop.
11.2 Manage an instructional organization, including defining jobs, hiring, organizing, and evaluating personnel.
11.3 Evaluate the operations of a given management system.
11.4 Build a team of personnel to cooperate and participate in the solution of instructional problems.
11.5 Develop a system for storing, managing, and accessing records of personnel, equipment, or other instructional resources.
11.6 Use appropriate computer tools to accomplish management tasks.

12. Monitor Instruction/Training Projects
12.1 Identify the sequence of tasks required by a project and prepare a timeline for accomplishing them.
12.2 Evaluate a given instructional development project plan and timeline.
12.3 Plan and coordinate logistical support (scheduling, budgeting, meeting space, and other support systems).

13. Design and Deliver Instructional Messages
13.1 Write or edit instructional or informational materials that clearly communicate the instructional intent, using accepted rules of style and form.
13.2 Develop training job aids in lieu of traditional instruction when appropriate.
13.3 Make verbal presentations that are clear, relevant, interesting, and easily understood by the audience.

(Continued)
13.4 Develop various conceptual models for describing complex ideas in ways that will help learners understand the ideas.
13.5 Design and develop effective visual communications such as diagrams, tables, overheads, and charts.
13.6 Write effective documentation, training manuals, and other forms of training texts.

14.1 Assess the needs and goals of a group and influence the group to work toward and complete the task assigned.
14.2 Demonstrate interpersonal behaviors with individuals and groups that are sensitive to their needs.
14.3 Consult effectively with clients and contract for services to the satisfaction of both parties.
14.4 Adapt behavior to different people in order to build a stronger and more effective relationship with them.
14.5 Help individuals recognize and understand personal needs, values, problems, and goals, and the alternatives for achieving them.
14.6 Interview or question people, listening actively or design a questionnaire that captures needed information from people.

15. Promote Instructional Development and Systems Strategies
15.1 Promote diffusion and adoption of the instructional development process.
15.2 Select, develop, and use appropriate research methods and skills, such as statistical analysis and tests and measurements, in the conduct of research.
15.3 Scan, synthesize, and draw conclusions from research data found in research reports or program evaluations.
15.4 Write effective project reports, progress updates, memos, and executive summaries.
15.5 Use a variety of computer-based tools to identify and locate appropriate information sources and instructional tools.

16. Provide Human Resources Development in an Organization
16.1 Define the organizational structure (chain of command) and the political power structure in an organization.
16.2 Determine a course of action which accounts for and reconciles many, often inconsistent, goals.
16.3 Identify decision makers, set an agenda, negotiate with them, and influence their decisions in ways that will accomplish organizational goals and support your services.
16.4 Identify institutional constraints that may affect a program or service and take action to mitigate the effects of those constraints.
16.5 Assess instructional alternatives in terms of their financial, psychological, and strategic advantages and costs.

17. Maintain a Professional Orientation
17.1 Maintain professional standards by fulfilling your contractual obligations by the contracted date.
17.2 Be willing to explore and use a broad range of ideas and to change perspectives and approaches when necessary. Think logically and creatively and remain open-minded.
TABLE 4
Course × Competency Matrix

<table>
<thead>
<tr>
<th>Professional Orientation Core</th>
<th>Corporate Training Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Behavior in Organizations</td>
<td>3 X X X X X X X X X</td>
</tr>
<tr>
<td>Organisational Development</td>
<td>X X X X X X X X X</td>
</tr>
<tr>
<td>Human Resource Development</td>
<td>X X X X X X X</td>
</tr>
<tr>
<td>Learning Foundations Core</td>
<td>X X X X X X X X X</td>
</tr>
<tr>
<td>Cognition and Instruction</td>
<td>3</td>
</tr>
<tr>
<td>Adult Learning and Education</td>
<td>3</td>
</tr>
<tr>
<td>Instruction to Tests Measurement</td>
<td>3</td>
</tr>
<tr>
<td>Instructional Development Core</td>
<td>3</td>
</tr>
<tr>
<td>Instructional Design: Front End Analysis</td>
<td>3 X X X X X X X X X</td>
</tr>
<tr>
<td>Instructional Design: Strategies and Development</td>
<td>3 X X X X X X X X X</td>
</tr>
<tr>
<td>Managing the Instructional Development Process</td>
<td>2 X</td>
</tr>
<tr>
<td>Instructional Development Consulting Skills</td>
<td>2</td>
</tr>
<tr>
<td>Analyzing Learner Characteristics</td>
<td>2 X X X</td>
</tr>
<tr>
<td>Formative Evaluation</td>
<td>2</td>
</tr>
<tr>
<td>Production Core</td>
<td>(8 or more)</td>
</tr>
<tr>
<td>Developing Instructional Text Material</td>
<td>3</td>
</tr>
<tr>
<td>Developing Interactive Computer-Based Instruction</td>
<td>3</td>
</tr>
<tr>
<td>Producing Instructional Media Materials</td>
<td>3</td>
</tr>
<tr>
<td>Portable Video Production</td>
<td>2</td>
</tr>
</tbody>
</table>

The table above represents the course competencies and their corresponding corporate training programs.

Summary

In this article, the growth of corporate training from historical and conceptual perspectives was described. The process of instructional development in the corporate environment was compared to the educational environment, and, based upon several needs assessments, it was concluded that the needs of educators and trainers are different. Two major needs assessments conducted by professional associations were reviewed and then a locally conducted critical incident needs assessment was completed. The competencies deriving from all of these studies were combined into a list of competencies for corporate trainers. Finally, an outline for an educational program to prepare corporate trainers was described in terms of the competencies previously identified. The increasing number of positions in corporate training, coupled with an increased willingness to "practice what we preach" (needs assessment, etc.), will strengthen educational programs in universities and gain the respect of the corporate training community, making our programs and graduates more appealing.

References


The Instructional Designer–Subject Specialist Relationship: Implications for Professional Training

Gary R. Morrison
Associate Professor
Department of Curriculum and Instruction
Education 424
Memphis State University
Memphis, TN 38152

Abstract. The training of graduate students for instructional design positions in a business environment must go beyond a knowledge of traditional instructional development models. Based upon an analysis of the business environment, three areas for skill development—group process, communication, and problem-solving skills—are identified. Strategies for increasing graduate students' contacts with subject specialists are discussed.

Can you recall the last time you worked on a design project in a new content area without the assistance of a subject specialist? Most of us would balk at the thought of trying on our own to determine the effect of a Boolean equation on the state of an electronic gate, or to determine the size of a separator vessel based on our understanding of the gas laws.

The very nature of the instructional design process makes the designer dependent on others to complete the instructional materials. An instructional designer can be characterized as a process-oriented individual who can apply a version of the process to any content or discipline area. We can classify the designer as the process half of the process-content continuum, and the subject specialist as the content half. Most designers would argue that this unique mix of process and content is necessary for effective instruction—though one is less likely to develop effective instruction if the instructional design process is missing. On the other hand, subject specialists, would, and often do, argue that the design process is unnecessary for them to deliver effective instruction.

The difference in perspectives between the designer and the subject specialist is seldom verbalized, yet it is critical to understanding the relationship between the two participants. As a result of the process focus, the designer places an emphasis on improving the delivery of the instruction through the development process. This process often involves the coordination of content in the delivery (i.e., design of instruction, selection and media, etc.) of the instruction. The subject specialist’s focus, however, is on the content, since it is often the most pressing problem from the content perspective. This difference in initial perspectives can result in a continual struggle between the designer and the subject specialist during the course of a project.

The purpose of this article, however, is not the resolution of the differences in perspectives. Rather, it focuses on the relationship between instructional designers and subject specialists in business and industry, and the implications of this relationship for the development of related skills in graduate instructional design (ID) programs. In the first section of this article, the ID environment in business and industry is described, with a specific focus on the instructional designer/subject-specialist relationship. The second section provides recommendations for the development of instructional design skills in graduate-level design courses.

The Instructional Design Environment

Before a project can begin, the designer must identify the individuals involved and their roles, as well as the role of the designer. The practice of ID in business and industry can range from a single individual who serves as a subject specialist, designer, instructor, and personnel manager, to a large corporation where individual designers have specialized roles. For example, in a large corporation one person may be responsible for conducting needs assessments, another may have responsibility for project design, another may develop training materials, and still another may have responsibility for project management and evaluation. The various roles of the instructional designer, the subject specialist, and client are described in this section.

The first role to describe is that of the client in the business and industry environment. Bratton (1983) defines the subject specialist as the client and as the individual responsible for a group of learners. In the business and industry environment, one must typically look beyond the instructional designer/subject specialist relationship to define the role of the client. The contract with the designer, either formal or informal, to
perform a service is typically with a manager or supervisor of the target population rather than with an instructor. The "contract" may be to solve a performance problem or to provide general instruction. This performance contract is different than the psychological contract that exists between the designer and the subject specialist described by Coldeway and Rasmussen (1984). In this environment, the client is the manager or supervisor of the target population with a need. As a manager, the client is often responsible for the target population's job performance. The instructor's responsibility for the target population seldom exists beyond the instructional environment.

The role of the subject specialist typically is filled by a person with special expertise: the company's top performer or most knowledgeable person on the topic. This individual may be a consultant to the design team and have no responsibility for the delivery of training (e.g., instructing). The instructional materials would then be delivered by an instructor or a training administrator. As suggested by Bratton (1985), typically the major responsibility of the subject specialist in the business and industry environment is providing accurate content to the design team as opposed to supervising the learner's achievement.

This split in the roles of the client, subject specialist, and instructor places the instructional designer in the role of project leader with responsibility for both the design and management of the project. The client's responsibility shifts from managing the project to one of providing the designer with access to the resources needed to complete the project. With the project management responsibilities, the designer assumes the task of establishing the work schedules and deadlines for the project. The identification and understanding of these roles are essential to the success of a project. Graduate students need to be aware of the different roles and responsibilities of development project team members in various environments if they are to function effectively.

**Recommendations**

If graduates are to enjoy success in their jobs, the teaching of instructional design skills must go beyond the models presented in textbooks (e.g., Bratton 1979, 1981, 1983; Coldeway & Rasmussen, 1984; Haney, Lange, & Barson, 1968; Hoban, Heider, & Stoner, 1980-1981; Morrison, 1985). Three sets of skills complement the design process and are essential for a successful project: group process, communication, and problem solving. The following paragraphs describe the nature and importance of these skills for graduate training in instructional design.

**Group Process Skills**

The development effort for a project can include a group as small as the designer and the subject specialist, to a full-fledged team consisting of a designer, developer, subject specialist, scriptwriter, producer, evaluator, and a program review panel. At a minimum, most teams are responsible to a subject specialist advisory group or to a program review panel for content accuracy. The leadership role of the development team and the review panel(s) requires the designer to have a minimal understanding of group process skills.

First, the designer's group process skills should include a knowledge of how to plan and conduct an efficient meeting. The designer must make efficient use of the subject specialist, development team, and review panel's time. Thus, a knowledge of how to plan and serve as leader of these meetings is essential for completing planned agenda items and maintaining the group's focus.

Second, the instructional designer should know how to develop a team to accomplish the project at hand. Most teams are an eclectic (at least to professionals in business and industry) collection of individuals who must sort out their roles and territory to become effective and efficient in completing a project. The responsibility for developing this team rests with the designer, since he or she is typically the project leader.

Third, the designer should develop skills for achieving group consensus. If this skill is lacking, the team can waste a considerable amount of time reaching agreement on both trivial and important points. The designer must recognize disagreements and then implement a variety of strategies to move the group to a consensus.

Fourth, the designer should develop conflict-resolution skills to use when individuals disagree. Individual credibility, team rapport, and complete projects can be destroyed through unresolved conflicts. The designer needs to develop skills to resolve conflicts at their earliest stage and within the confines of the team in order to preserve the team.

**Communication Skills**

The designer must develop one-on-one communication skills to support the content analysis effort. There are three specific skills a designer needs to support the process. First is effective listening—knowing how to listen, acknowledge, and encourage the subject specialist to continue to explain the task. Second is an understanding of body language, which would be helpful in reading the subject specialist. Third is the development of probing.
skills—an understanding of how to get to the crux of an issue. The designer needs to be proficient in probing the subject specialist for all the information required to develop the product. These communication skills are essential for the thorough completion of the content analysis.

Problem-Solving Skills

The designer needs to develop problem-solving skills that are different from the structured approaches presented by Kepner and Tregoe (1965). Problem-solving skills which address immediate problems, such as logistics or technical problems, are needed. For example, the team might be faced with obtaining specific equipment for use in a videotape or in a course. Another example might involve subject specialists who believe that a user interface for a particular computer program should be changed before it is introduced in a new course. In this situation, the designer is faced with a problem that goes beyond the group, yet will ultimately affect the outcomes of the project.

The Subject Specialist in Graduate Training

One method for developing process skills is to require that graduate students work with a subject specialist in the process of completing course projects. If students work with a subject specialist in business, they will gain additional knowledge about the design process that cannot be easily conveyed through lectures, role plays, or textbooks. Students will also gain experience in working with a content area in which they have little knowledge. This experience will require them to focus and rely on the design process as opposed to “writing” content from textbooks or their own personal knowledge base. In addition, it will help them gain confidence in the design process. Last, they can gain experience in a noneducational environment and have materials to supplement their portfolios which can increase their chances of obtaining employment in a business setting.

There are also some drawbacks to requiring or encouraging students to work with individuals outside an academic setting. As a professor, one is endorsing a student to work with a professional as a professional, yet the student is a novice, not a professional. The student learns a step of the model one day and is required to practice it as a professional the next day. Any failures on the part of the student may be seen as a reflection on the project's performance and damage prospects for future internships and job placements. A second problem is the time frame imposed by the semester's schedule and by the subject specialists' schedule. Ground rules need to be established at the beginning of a semester governing the conditions for an incomplete grade. There will be times when the subject specialist will not be available, when wrong or incomplete information will be given to the student, or when reviews take longer than planned. Some students will be unable to complete their projects due to conditions beyond their control, while other students will simply fail to manage their time appropriately. Guidelines are also needed to deal with these situations.

One additional drawback is the scope of the different projects. For example, one student might have a rather simple project on using an electronic bank teller, while another has to develop instruction for managers on evaluating and classifying their subordinates' positions on a performance evaluation and classification form. Will the evaluation of the projects include consideration of the thoroughness of each project, and will considerations also be given to the complexity or difficulty of the projects?

Strategies for Implementation

Most of us recognize that graduate students need experience and training in working with subject specialists, and typically provide this experience at the end of the students' program as an intern. However, it is this author's position that graduate students need the experience of working with a subject specialist from the beginning of their program. The following is a description of how to implement this strategy.

... graduate students need the experience of working with a subject specialist from the beginning of their program.
of two approaches we have implemented for providing this early experience with subject specialists.

The first approach is to establish a program relationship with a service group or department on campus that is willing to cooperate in the venture. Such a program has been established at our main library with the Instructional Librarian. She has several projects that would be "nice to have," but does not have the staff or time to develop the materials. She has agreed to work with our students and provide them with a subject specialist (usually another librarian) for their projects. At the end of the course, the instructional librarian receives the units of instruction. During the past three years, students have developed units on conducting searches with ERIC, Psychological Abstracts, Dissertation Abstracts, and a Citation Index; planning a library search; using the on-line card catalog; using Boolean algebra to narrow or broaden a search; and conducting an electronic data base search. Thus far, the program has been quite successful for both the instructional design students and the library.

The second approach is to develop a cooperative relationship with local businesses. Previous graduates, other instructional designers, and managers who have an understanding of our program have been contacted. In an initial meeting with the instructor, the business representative is briefed on the academic program goals and the constraints imposed on the project by the course. The representative identifies meaningful projects that can be completed in a semester to fulfill the course requirements. The business representatives help the students by arranging meetings with subject specialists, but do not provide other support that would influence the students' work. This arrangement has potential for training graduate students to work with subject specialists in business settings.

Providing graduate students with opportunities to work with specialists in an unfamiliar content area provides the students with an opportunity to develop and refine their group processes, communication, and problems-solving skills. In addition, the student projects help to gain local visibility for a program, which may result in an increased job market for graduates.

References


Subject Specialist Consultation in Instructional Design: Higher Education

Martin Tessmer  
Assistant Professor of Instructional Design  
College of Education  
University of Colorado at Denver  
Denver, CO 80204

Subject specialist consultation remains one of the most vital instructional design skills. In two separate surveys of job skills needed for training and media developers, interpersonal skills with subject specialists was ranked as one of the three most important skills for professional competence (American Society for Training and Development, 1979; Deden-Parker, 1981). Another survey of competencies for instructional development professionals has listed interpersonal consulting skills as one of the core competencies for instructional developers (Task Force on ID Certification, 1981). Recently, the University Consortium for Instructional Development and Technology (UCIDT) suggested there be a conference symposium to teach students how to interview subject matter experts (Reiser, 1986), indicating its importance as a design skill.

While the ability to competently interact with subject specialists is a necessary and critical skill for instructional developers, education and training programs for developers may not teach the skill (Wallington, 1980). For students and practitioners of instructional design, there is a need to know the processes and problems of dealing with subject specialists in instructional development.

Thus, practitioners need to know more about methods for effectively conducting designer–subject specialist interactions. These subject specialists can be in business, higher education, government, the military services, or the health sciences. On the other hand, instructors of future instructional designers need to know what interaction techniques their students should learn and how students can learn them. Part of this student learning process includes learning the characteristics of subject specialists in a given field, and how to resolve problems that arise when working with those specialists.

This paper outlines one practitioner’s view of designer–subject specialist interactions in higher education. Four topics will be reviewed:

- subject specialist characteristics that affect the design process
- consultation problems that arise from subject specialist characteristics
- interaction strategies/tools to alleviate consultation problems
- methods for teaching consulting strategies to students in instructional development programs

Just as instructional designers are differentiated by their field of endeavor, subject specialists can be differentiated...
The subject specialist in higher education is frequently both the client and the user of the products produced in a media project.

by theirs. Subject specialists in higher education are different from those in business, and these two types are generally different from those in the military services. The author's comments are based on six years' experience as an instructional designer for the faculty and administration of several institutions of higher education, with the last three spent as the sole designer for a three-college higher education complex that includes a community college, a four-year college, and a graduate institution. During that time, the author has worked with over a hundred subject specialists on projects that involved the design and production of a wide variety of instructional materials.

Characteristics of Subject Specialists in Higher Education

Most subject specialists have little knowledge about the instructional design process. They are often interested in media production and expect media production advice that concerns production costs, program length, and proper media format. This expectation is common to a number of instructional design centers in higher education (Mellon, 1982; Schrock, 1985). The instructional designer is seen as a media specialist or production consultant. However, "instructional" advice about task analysis, objectives, or instructional strategies can be unexpected and unwelcome, because the subject specialist may not perceive these areas as part of the designer's expertise (Schrock, 1985).

The SME as Client and User

The subject specialist in higher education is frequently both the client and the user of the products produced in a media project. Almost all media project subject specialists are faculty who have initiated the project request and intend to use the methods and materials produced in the project. Hence, they have a sincere interest and involvement in the project. However, designers can find it difficult to implement an instructional design procedure that the subject specialist does not accept. The subject specialist can argue against a designer's recommendation on the basis that the specialist is: (1) an initiator and "co-manager" of the project (with the designer), (2) the user who must live with the results of the project, (3) a teacher who has the academic freedom to conduct instruction as he or she sees fit.

The dual role of the subject specialist as the expert and initiator/user/teacher can create personal interaction and project management problems. Part of the difficulty is that higher education instructional design services may not have a process for appointing someone as a project director that serves as the "last court of appeals" to determine the content, process, and features of the project. In business and the military, project directors are more unequivocally designated.

In higher education, instructional designers may be appointed to help the subject specialist produce effective instructional materials, but the subject specialist is responsible to an academic department chair who may have little awareness or involvement in the project. In colleges and universities, subject specialists are accorded independence and authority rarely found in other fields of instructional design practice. They are not hired or appointed to a project, and may see themselves as "hiring" the instructional designer to work on their projects.

The Subject Specialist as Instructional Developer

In higher education, subject specialists are experienced instructors who have their own ideas about instruction and instructional development. Most of them have organized and taught courses for years, and thus have established beliefs about how to plan and deliver instruction. As a result, they may disagree with a designer's recommendations to conduct task analyses or write objectives. However, such objections are not based on the commonly heard reasons that the subject specialist already knows the subject or does not.

In higher education, subject specialists are experienced instructors who have their own ideas about instruction. . . .
understand the design process. Instead, the reason is that these subject specialists are experienced instructors and "designers" in their own right. They may have a type of learned disagreement with the design process, in the form of these objections:

1. Their subject is too complex to be amenable to simplification procedures of instructional design, such as identifying outcomes or conducting task analyses.

2. The project goal is to educate students, not train them. Task analyses, objectives, and instructional strategies are more useful for training development.

3. Instructional design is an effort to compartmentalize and dissect the learning process. The very questions asked by an instructional designer (e.g., "What is your objective?") should not be asked, since they represent the wrong approach to education.

4. Subject specialists have successfully taught their subject a number of times. There is no need to determine outcomes, content, or instructional strategies. One simply converts instruction to a computer lesson or video program.

Here, the problem is not just that the subject specialist has no understanding of the design process or does not have the time to do it (which are other valid problems), but rather that he or she sees the design process as superfluous or wrong. In some cases, these beliefs may be non-negotiable (Locatis, Weisberg & Toothman, 1984). Again, owing to the status of the subject specialist as client and user, negotiating with a designer over these objections can become sensitive and challenging.

Strategies for Working with the Subject Specialists

The interaction problems between designers and subject specialists are formidable. Several different strategies can be used to alleviate the problems. Some of these strategies relate to materials which are given to the subject specialist, while others involve ways of working with the subject specialist.

Preplanning Surveys and Outlines

Surveys and outlines can prepare the subject specialist for the initial interview with the designer. These materials help solve two problems: (1) the subject specialist is uninformed or misinformed about the design process, (2) the subject specialist is both the client and the user of the products produced. The designer can give the subject specialist two handouts before they meet to discuss the project, hence the name "preplanning." One handout is a preplanning questionnaire about the proposed project (Appendix A). The other is a production outline of the steps and stages of the design/production process for projects such as telecourses or computer-assisted instruction (Appendix B).

The preplanning questionnaire serves two important purposes. First, subject specialists who complete the questionnaire furnish the designer with information about their conception of the project. Second, as the subject specialists complete questions about outcomes, learner characteristics, and media formats, they become aware of the content and complexity of the design process. The questionnaire serves as an "advance organizer" that informs the subject specialist about elements in the design process. This makes it easier to explain and implement the process in subsequent meetings. As indicated by Bratton (1983), clients must be prepared in advance for the initial instructional design interview. Preplanning surveys accomplish this goal.

In some cases, the subject specialist may not understand some of the questions on the survey, such as a question about learning guidance or formative evaluation. However, the designer can tell the subject specialist to request clarification of questionnaire items dur-

... the problem of mentally "shifting gears" to understand and empathize with each subject specialist can be difficult and tiring.
Handouts function as a consultation job aid for the designer.

ing their initial meeting. Explaining aspects of the instructional design process at the subject specialist’s request keeps the designer from using the initial meeting to give unneeded lectures about instructional design. Instead, the designer gives a quick overview of the design process and responds to the subject specialist’s specific inquiries.

Production outlines are used to delineate the design and product steps of expensive, labor intensive projects such as computer-assisted instruction or instructional television. They also describe the duties of the subject specialist, instructional designer, and production staff involved in the project. Subject specialists who read the production outlines for a project will have a better understanding of the stages, roles, and time requirements of the production process. They will understand that determining outcomes and conducting task analyses are part of the regular and expected procedures for designing project materials, and that a successful project may require a substantial investment of their time.

After reading and completing such preparatory handouts, the subject specialist will come into initial planning meetings with a better understanding of the instructional design process. This happens without the designer preaching or teaching about the design process or overwhelming the subject specialist with details and questions (Coldewey & Rasmussen, 1984; Bratton, 1983). A further benefit is that the subject specialist can privately reevaluate any conceptions about the design process, and can change his or her opinions without losing face.

Preplanning surveys and outlines are forms of handouts, a consultation tool that has been used by other designers to prepare clients and facilitate communications (Spitzer, 1987; Ruggiero, 1985). Handouts function as a consultation job aid for the designer. With handouts, the designer’s main duty is to tactfully introduce these forms to the subject specialist as part of the planning process. The designer should explain that the handouts will help the designer understand the subject specialist’s perceptions of the project. Part of the initial planning session is then devoted to discussing the subject specialist’s responses to the handouts.

Flexible Interaction Strategies

While preplanning surveys and outlines help clarify the instructional design process, flexible interaction strategies help manage it. In working with subject specialists who are initiators and users of the project results, the designer must be prepared to adjust their level of assertiveness according to the magnitude of their role in the project. Some writers see the designer as an assertive leader in a project (Coldewey & Rasmussen, 1984). Others have indicated that the designer can succeed best as an advisor who suggests options to subject specialists (Davies, 1975; Willis, 1963). In cases where the subject specialists are the primary users of a product, they have the right to reject a designer’s suggested instructional methods, materials, or planning activities (such as task analysis). In such cases, an advisor’s role may be most appropriate for the designer.

However, contrary to much of the literature about designer consultation roles, there is no one role that a designer should adopt in every situation. Rather, designers must be flexible enough to adapt their roles to the nature of each project and each client. The designer may become more assertive and directive with a subject specialist in some projects and more consultative and collaborative in others. What determines the role adopted? The designer’s perceptions of the magnitude of the project and its potential users.

For example, as the size of the project increases, or the dissemination of the project extends beyond the subject specialist’s use, the designer becomes more responsible for ensuring the instructional quality of the project. A project such as a telecourse requires a considerable expenditure of institutional staff and resources for its production. Furthermore, the students and teachers who will use the project results transcend the individual subject specialist’s responsibilities. These teachers and students become part of the “client system” to which the consultant is responsible (Lippitt & Lippitt, 1965; Letzmann, Walter, Earle, & Myers, 1979).

In large-scale projects, the designer must become more of a co-director and less of an advisor, to the point that the designer may insist that certain activities or features be included in the project. The reasons for the designer’s more aggressive stance are not only based on design theory and research, but also on the twofold obligation not to waste the resources of the institution and to provide multiple users with quality instructional materials. However, even when a more assertive position is adopted, the designer should seek to maintain a collaborative and empathetic role with the subject specialist.

Listening and Consultation Heuristics

As stated earlier, the variety of subject specialists in higher education can burden the designer’s ability to consult on a number of projects at once. To cope with this demand, there are several heuristics that a designer can use to
better understand the subject specialists and reduce mental fatigue.

First, the designer should try to pace and space planning and production meetings. This can minimize cognitive dissonance or fatigue that can result from scheduling meetings too close together. For example, a designer should be wary of scheduling successive meetings with, say, a statistician and a philosophy instructor. Similarly, an intensive budget or personnel meeting can diminish a designer's ability to fully attend to a crucial client entry consultation that follows.

Second, designers must use the active listening skills of probing and reflecting. Probing is a frequently mentioned consultation activity for all types of consults (Lippitt & Lippitt, 1956; Gallese, 1982). It mainly involves questioning clients in order to clarify their remarks and responses. Reflecting involves rephrasing or repeating clients' remarks, to better remember them and to demonstrate attention to their concerns. Probing and reflecting will help a designer understand a subject specialist's cognitive framework. In particular, probing reduces a designer's effort to understand a subject specialist, because it enables the specialist to explain his or her viewpoints instead of the designer having to figure them out.

Third, the designer must remember the power of informal conversation (Locatis, Weisberg, & Toothman, 1984), which is useful in helping the subject specialist and the designer to know one another and in inducing a spirit of collaboration. Icebreaking and tension reduction skills are part of the competent design consultant's repertoire (Bratton, 1979). Informal conversation is an excellent way to break down the walls between designer and subject specialist and create a relaxed mood for interactions.

Recommendations for ID Training

A four-step training process can be used to train future instructional designers in interactions with subject specialists. This process is currently being used in an instructional design program at the University of Colorado at Denver. The training process is similar to that outlined by Savage (1975), and involves the following student activities.

Observing correct and incorrect interaction situations. Instructional design students should view situations that are examples and nonexamples of how interactions between the subject specialist and designer should be conducted. The situations could be on videotape or videodisc, role-played, or published as case studies. Incorrect characteristics and procedures should be clearly identified. The examples are used to develop concepts of consultation techniques.

Critiquing interaction situations. Given a variety of examples and nonexamples of correct interaction behaviors, the student learns to determine the appropriateness of the behaviors for the consultation situation. At this stage, the student should select and justify consultation strategies.

Role-playing interaction situations. Students are given the chance to take the part of a designer who must work on a project with a subject specialist. Then, the student assumes the role of a subject specialist and works with a designer. In some situations, the student in the role of subject specialist can be instructed to adopt a particular type of behavior or attitude toward instructional design to see how the designer in the role play reacts. The designer should determine how the subject spe-

. . . designers must be flexible enough to adapt their roles to the nature of each project and each client.
specialist is reacting, and decide whether to change his or her communication style to better conduct the planning process. As a supplement or replacement for live role playing, interactive videodisc can also be used. The computer can play the role of the subject specialist and require responses from the student who is playing the role of designer.

Conducting client interactions in field situations. Student designers can acquire interaction skills through the use of instructional design internships. Students who seek higher education employment can be assigned to work on faculty design projects in which they conduct planning meetings or co-conduct with a resident instructional designer. Above all, the student’s consultation behaviors must be reviewed during the internship, not after its completion. Conducting reviews during the internship allows students to correct their consultation behaviors and reappraise them in other projects.

For updating or retraining practicing designers, national conferences should provide yearly workshops and symposia on interacting with subject specialists. In particular, more training could be given on the preplanning stage of a development project, that is, what should be done before the initial planning meeting.

Summary

The instructional design process in higher education has its own distinct problems and processes, as characterized by the unique characteristics of subject specialists in higher education. While the perceptions and background of subject specialists may occasionally pose problems to the instructional designer, the use of preplanning handouts and flexible interaction strategies can facilitate the instructional process and help guarantee the success of a project.

References


Appendix A

Instructional Design Preplanning Outline

I. General Information
1. Name ___________________________
2. Date ___________________________
3. Title/Theme of Project ________________
4. Content areas covered in program ________________

II. Instructional Design Information
1. Need for project ________________

2. Uses for Product (Check all that apply)
   - Prepare students for classroom instruction
   - Supplement classroom instruction
   - Stand-alone instructional modules
   - Promotional
   - Staff development or in-service
   - Continuing education
   - Other ________________________

3. Target Audience (Complete “a” through “e”)
   a) □ Students □ Faculty
   □ Staff □ Public
   b) TOTAL # ________________________
   c) Age Range __________ yrs.
   d) Educational Background ________________________
   e) Other relevant characteristics ________________________

4. Major Instructional Objective of Program
   a) What will target audience learn from the program? (check one)
      □ Creative Problem Solving (how to solve problems, locate things, create original products or methods, etc.)
      □ Application of Principles (how to apply specific rules to specific problems or situations, solve equations, perform a task, etc.)
      □ Concept Learning (how to identify examples of some object, idea or activity, to classify parts of something, name things, etc.)
      □ Motor Skills (how to execute or perform some coordinated body movement such as dancing, swinging a bat, writing, etc.)
      □ Verbal Information (statements or facts about things, such as dates, weights, measures, rhymes, quotations, rules, etc.)
      b) Describe the major objective checked above (what audience will learn).

5. Other Objectives of Program
   a) What sub-objectives must audience learn from the program in order to learn the major objective above? (check all that apply)
      □ Creative Problem Solving
      □ Application of Principles
      □ Concept Learning
      □ Motor Skills
      □ Verbal Information

(Continued)
Appendix A Continued

b) Are there any attitudes or feelings you wish to develop in the audience, such as punctuality, enthusiasm, attention to detail, respect for law, preference for art courses, etc. (Please describe below)

☐ Support graphics (signs, transparencies)
☐ Documentation of program effectiveness (reports of evaluation results and/or tryouts of new program on test audience).
☐ List of program objectives and sub-objectives

7. Possible Media Choices
Check off any types of media that you think are instructionally appropriate for presenting the program
☐ Audiocassette
☐ Slide/audio-tape
☐ Filmstrip/audio-tape
☐ Slides
☐ Real objects
☐ Filmstrip
☐ Print text
☐ Videotape
☐ 8mm motion picture

III. Production Information

1. Distribution Environment
Where will project be used?
(Check all that apply).
On Campus: 
☐ Classrooms
☐ Office/meeting at other rooms
☐ Closed-circuit TV
☐ Cable TV
☐ Commercial marketing/TV

☐ Other: __________________________

2. Will people be used as actors or participants in the program?
☐ Yes  ☐ No

3. What is the expected lifespan of the program content?
__________________ years

4. Will the program need to be revised?
☐ Yes  ☐ No
If yes, how often?

THANK YOU FOR YOUR TIME
Appendix R

Video Production Agreement for Disseminable Video

OPTION ONE: ON-CAMPUS AND OFF-CAMPUS USAGE

Definition:
Productions in this category may be used in a variety of ways: off campus via cable TV, commercial television, or local playback at individual sites; on campus; or any combination of the above. In some cases, the program may be marketed as a telecourse package. These productions, ranging from a single program to a complete telecourse, are usually produced in the studio.

Examples:
- Multi-unit telecourse
- Speech by a visiting notable
- Public service announcement

Planning Activities:
Under this option, planning will include:
- Determining the objectives of the program
- Selecting instructional strategies and activities
- Writing a script
- Determining production methods/strategies
- Developing a production calendar/timetable
- Designing evaluation instruments
- Recommending related print material
- Outlining instructor's guide
- Developing a contract, including division of royalties, for programs to be marketed
- Determining marketing and dissemination plan for the program
- Obtaining signed model releases

*Optional steps
The papers by Morrison and Tessmer reflect the experiences of two instructional designers who work in quite different organizations. They have described a number of common observations and concerns as well as some unique ideas. Perhaps the idea that stands out most in the papers is the apparent contrast of roles of the designer vis-à-vis the subject specialist in various working situations. Consider the university situation described by Tessmer in which the designer serves as a consultant to the subject specialist. In this case, the subject specialist will use the instruction in his or her own classroom. Tessmer’s paper offers a number of suggestions for handling this relationship. At the other extreme is the business and industry situation described by Morrison in which the roles often are completely reversed. The decision maker in this case is likely to be the designer and the consultant the subject specialist.

Morrison has made the interesting observation that there really is a continuum and not a dichotomy in this situation. He describes the situation in which one is creating instructor-led training in which there will be multiple sections and multiple instructors for a course. While both the subject specialist and the designer maintain their respective interests in the content and its delivery, it is not a clear either/or situation. They must both recognize the strengths and weaknesses of the instructor who will eventually deliver the instruction.

How important is this role reversal for the designer? At this point, it’s not entirely clear. For example, both of the papers refer to problems, regardless of the setting, that the designer must anticipate in working with the subject specialist: the specialists want to teach everything, they rarely recognize a need for an instructional designer, they know what they want, and they are always busy. Morrison and Tessmer have directly or indirectly indicated that the problem is how to work effectively with a subject specialist, regardless of the setting in which the work is to be accomplished.

The primary solution proposed by Morrison and Tessmer is to train designers in interpersonal, group process, and communication skills. Morrison has been very specific in his recommendations for how the designer should be trained to handle the relationship. He suggests, for example, that the subject specialist should be made to feel good about the project and develop some sense of ownership, and that the designer should avoid instructional development jargon and be graceful in dealing with the “sacred cows” that are a part of every discipline.

The specificity of these suggestions will be helpful in terms of their use in classes that deal with this aspect of instructional design. A possible addition to the list of skills is the use of formative evaluation procedures as a method of arbitrating subject specialist-designer disagreements. For example, trying out prototype tests or sets of instructional materials with students can provide face-saving answers to many questions...
... technical design skills—you can't be a very good designer without them, no matter how good you are at other things.

The authors have highlighted another aspect of a successful relationship with a subject specialist. Designers must be confident that they have the instructional design skills that will be required to successfully carry out a project. This is not arrogance, but rather a perception of ability to succeed based on successes in the past in similar situations. This seems to be the crux of the situation. How does the designer reach this state of quiet confidence in his or her ability to work with a subject specialist?

Most people who hire designers in industry or instructional support centers assume that both design and interpersonal skills have been taught in the academic training programs that prepare instructional designers. It's a fair assumption, and at least partially true. Students in instructional development programs vary in both their academic and interpersonal abilities. In nearly every program with which this author is familiar, the major emphasis in the curriculum is on the development of the technical design skills—you can't be a very good designer without them, no matter how good you are at other things.

How are interpersonal and communication skills taught? Mostly through trial and error in assistantships, internships, and initial jobs on campus. There is no question that most instructional designers practicing today first learned about the unique particularities of subject specialists by sitting across the table from one in a project meeting. This pseudo-on-the-job training is certainly not all bad. A lot has been learned under these circumstances.

However, Tessmer has suggested that the training programs for design students should include the opportunity to observe interactions, to critique the interactions, to engage in role playing, and eventually to do something he calls "doing interactions in field situations." At Florida State, a course has been developed which includes many of these opportunities. The course, "Developing Instructor-Led Instruction," is offered to students who have already completed a basic instructional design course in which they produced and evaluated a unit of print-based instruction.

In this second design course, each student serves as both a designer and a subject specialist. Students identify a specialty area in which they would like to deliver a one-hour workshop, and other students in the course are assigned to work with them as the designers of the workshops. These assignments are made very early in the course so that each student is playing a dual role: as a designer of a workshop in a content area with which he or she is not familiar, and as a subject specialist who is having a workshop designed for him or her to deliver. The focus of the instruction in the course is on the skills needed by the designer to produce group-based, instructor-led instruction.

During the first offering of the course, the instructors paid relatively little attention to the quality of the relationships that were developing among the students as they played their two roles. The students were told to see the instructors if there were problems. Some did come, but very few. Each student was required to keep a log of meetings and to write a brief critique of the experience at the end of the course.

The reactions of the students to this dual role of designer in one situation and subject specialist in another were varied and often personally insightful. For example, one student recognized how his own submissive behavior as a designer had resulted in the domination of the project by the more assertive subject specialist. This student had a real insight into his own behavior and how it affected the outcome of the design of the instruction.

Some of the students' reactions were not positive. Several developed what might be considered hard-nosed attitudes about the situation. One stated that it was the responsibility of the designer to define the role of the subject specialist and that the specialist should not be consulted on development decisions that impact on instructional effectiveness.

Another student was even more adamant about the necessity of reaching an agreement about the roles of the people in the relationship. "If this had been a real situation, I would have refused to do the job until and unless the subject specialist agreed in writing to the amount and type of input that they would be providing, and that I could not be held responsible for the outcome if the amount and type of input was considered insufficient. I am not a mind reader!" One does not have to look beyond the lines to detect that this student felt he had been burned by the subject specialist who didn't deliver what was needed for the designer to do his job.

These student comments exemplify a major point in the course, and one that is made in the Morrison and Tessmer papers, namely the importance of each party in the relationship having an accurate perception of his or her role and of the expectations which will be made of them. In this regard, it is interesting that the views of the subject specialist are not represented in the Morrison and Tessmer papers. If they were, I'm sure they would also say, "Let's agree on what we are trying to accomplish, on what each of us will do, and when it will get done."

Perhaps this view is a little too simplistic, but it does seem possible to achieve this perspective if all parties understand their roles. In this regard, the brief forms described by Tessmer lay the groundwork between the de-
signer and the subject specialist by stating what instructional alternatives are available and how services will be provided. These documents are reviewed in private by the subject specialist and then discussed with the designer. The nature of the questions that the specialist must answer on the forms requires that agreement be reached on many aspects of the project, particularly that of the role of the subject specialist, before any work begins. While the forms themselves may not be appropriate in the context of business and industry, the concept and approach are. It may be predicted that, regardless of the setting, the greater the extent to which the subject specialist understands the total project and his or her role in it, the greater the probability that a successful relationship will exist between the specialist and the designer. An alternative result of this clarification process might be the termination of the relationship between the subject specialist and the designer. This may not necessarily be viewed as a negative outcome.

One more observation by a student in the Florida State course is worth noting. All the students' comments that have been referred to in this article were written from the point of view of the designer, but one student also chose to discuss his reaction to his role as the subject specialist-instructor for a workshop which was designed by another student. He states, "The use of instruction designed by another person reinforces the understanding of how various are the forms of human nature, even when they are following the same rules." No matter how well designers are trained, variety will continue to be the spice of life.
University and college lecturers are a special breed of educator: they seldom acquire, or are expected to acquire, specialized training (or qualifications) in the performance of a range of critical tasks which account for much of their working lives. In contrast to primary and secondary school teachers, lecturers seldom formally study topics such as curriculum planning, course design, teaching strategies, and student assessment. Lecturers are notoriously reluctant to attend faculty-development workshops and seminars related to developing teaching competence. Of course, none of this would really matter if the quality of university teaching was particularly high, or merely acceptable. But there is sufficient evidence from students and elsewhere to suggest that teaching skill among university educators is not particularly impressive.

In lieu of public efforts to develop teaching competence, one would hope that lecturers would privately study effective educational practice. For this to happen, lecturers need to have access to books and audio-visual materials on teaching in higher education. That is why the publication of a text such as Course Design for University Lecturers by Allen Miller is particularly significant.

Miller has written a useful book which attempts to help university and college teachers answer ten questions which are critical both in course design and course evaluation:

1. Why is this course being taught?
2. What new knowledge, skills, or attitudes do I expect my students to develop during this course?
3. What level of knowledge or skills do I expect in students when they enroll in this course?
4. For students to develop the attributes listed above, what experiences do I need to provide for them during the course?
5. Assuming equivalent background on entry, will all students benefit from essentially the same experiences in the course?
6. If students need to be offered a range of experiences, what variation is possible, given restraints on resources?
7. What resources are available for teaching this course?
8. Given the purposes of this course and the type of subject matter being learned, is there a logical order for the treatment of topics?
9. How will I know whether this course is progressing satisfactorily?
10. How will I know whether this course has been successful and whether certain changes could improve it for future groups of students?

The second chapter stresses the importance of clarifying the purposes of a specific course. Miller distinguishes among the terms, aims, objectives, and goals, and reviews some of the contradictory literature on the use of objectives. He provides useful examples of objectives, particularly from the curriculum of Newcastle Medical School. Miller supports the use of objectives in university and college education, but warns that there are difficulties to be avoided.

Chapter Three reviews some key student characteristics which should be taken into account during course design, including learning strategies, stages of development, orientation to examination, and personality factors. Such characteristics are clearly important; unfortunately, Miller provides inadequate practical guidelines about how they can be adequately addressed in course design.

The fourth chapter deals with the selection and sequencing of course content. Strategies derived from theories proposed by Gagné, Ausubel, and others are explained.

Chapter Five focuses on the selection of teaching methods. Miller briefly treats the most appropriate uses of lectures, discussions, tutorials, seminars, practicals, laboratories, field work, and syndicates and group projects. In a section headed "Individual Learning," Miller defines Keller's personalized system of instruction, audio-tutorials, programmed text, and computer-assisted learning. The final section in this chapter mentions distance education. Miller's treatment of teaching methods is necessarily succinct. The list of methods covered illustrates the variety of potentially useful teaching methods, but new lecturers will need to follow up Miller's references to find out how to put these methods to practical use.
Chapter Six discusses how to measure student progress and achievement. Miller draws extensively from the work of Benjamin Bloom and his associates, in which three broad categories of learning objectives are classified: cognitive, affective, and psychomotor skills. Miller discusses how to mark and grade different types of student work, including essay examinations and group work. In general, the chapter serves to warn new lecturers of the difficulties of accurately assessing achievement and assigning grades fairly. He reproduces a useful table which suggests how grades from A+ to F and 0 might be implemented.

In the final chapter, Miller considers course evaluation. He encourages lecturers to seek objective evidence about the effectiveness of their courses, and offers some pertinent examples of how to obtain such data.

Though I would highly recommend this book to lecturers who have had no formal training in education, some words of caution are necessary. Though Miller addresses crucial questions about course design and discusses considerations which are important in answering these questions, he does not provide the sort of detailed instructions which I believe most new lecturers require to be able to design courses in practice. Miller recognizes that readers will need to read much more widely on each of the topics discussed, and throughout the book gives detailed references to more extensive literature. Nevertheless, many new lecturers may be unwilling to invest the time required to search for, acquire, and peruse an extended reading list. Perhaps what is required is a much more detailed treatment of course design that provides considerably more practical advice than is contained in Miller’s text.

Miller’s well-referenced text clearly illustrates that researchers have tackled a wide variety of issues related to course design and have developed various theoretical frameworks to guide course design and implementation. Although Miller cites useful guidelines drawn from the work of a range of influential psychologists, the selection of theoretical frameworks is necessarily limited, and some instructional specialists will surely criticize the selection. For example, in his discussion of specifying and sequencing content, Miller does not explain how to derive a “learning hierarchy,” which is fundamental to Gagné’s notion of cumulative learning. No mention is made of the strategies proposed by Merrill and Tennyson,* which is surely a significant omission in a discussion of how to teach concepts and principles.

Cautions notwithstanding, Miller’s book is well presented and well written. It provides a useful overview of the complex operations and considerations which are involved in course design. If university and college lecturers can be persuaded to read this text, there is at least some hope that the quality of teaching in our universities and colleges will improve.—Retrieved by David Owens, NIHE, Dublin, Ireland.


It has been nearly 15 years since Robert Gagné published his first edition of Essentials of Learning for Instruction, and like fine wine, he improves with time. The intervening 15 years have been marked by an explosion of ideas and research in the areas of learning and instruction, most of which substantiate Gagné’s original vision. This second edition, with co-author Driscoll, is both overdue and welcome. Designed as a basic text about human learning and memory from the perspective of an information processing model, the book will be useful in undergraduate teacher preparation, as an adjunct in graduate courses, or for use in continuing education courses designed for teachers.

Few writers in the field can approach Gagné’s ability to articulate so clearly the concepts he presents, and admirers of Gagné’s literary style will not be disappointed with this second edition. The introduction alone is classic Gagné and well worth the price of the book, as it is a mini-seminar for the undergraduate student on research into cognitive processes using the information-processing model. Providing simple and clear definitions, the introduction differentiates research concepts such as principles, models, theories, reliability, validity, and experimental and correlational studies. It is clear, concise, and understandable. Citing appropriate studies to illustrate points, the authors introduce the practicing teacher to the relevance of research for classroom teaching. This introduction is one of several sections that have remained essentially unchanged from the first edition, and understandably so since it is difficult to imagine how it might have been improved.

Much of the rest of the book has undergone substantial revision, however, and there are notable additions since the first edition. Overall, the new edition is less esoteric and employs more concrete, useful examples of current information-processing models. An example of this is seen in the chapter on the processes of learning. In the first edition, these processes were linked with learning phases and influencing external events, but were not integrated in any way with the information-processing model. In the second edition, the processes of learning have been streamlined, integrated with the IP model, and relabeled to better reflect that model. The learning phase has been dropped, and the external events that influence instruction have been modified to be consistent with IP theory. Hence, “coding and storage entry” from the first edition has been relabeled “short-term storage” in the second. The first edition listed “suggesting schemes for coding” as the influencing external event. In the second edition, this has become “suggesting the activation of rehearsal and chunking.”

The processes of learning are more coherent and less artificial when presented in this manner. In addition, the external events influencing instruction are more specific, more numerous, and subsequently more helpful. The result of these changes is a useful expansion of the classic IP model, resulting in a more productive classroom application.

Chapters on motivation and learning strategies for students have been added to this new edition. The addition of the chapter on learner strategies is particularly useful for those implementing instruction. This chapter is purely cognitive and presents strategies both for internal processing and for managing motivation. Methods suggested for teaching these strategies

---

within the school curriculum will be particularly helpful to the classroom teacher. Another enhancement is the inclusion within chapters of questions which generally require a constructed response, followed by suggested answers. These questions, for the most part, encourage transfer of the preceding concepts into some common teaching vignettes. Summary exercises are included at the end of chapters, as well as occasional lists of audio-visual supplements. References have been substantially expanded, and the general index found in the first edition has been broken down into an author and a subject index, both helpful additions.

Despite the general updating and re-conceptualization found throughout the book some troublesome areas remain. While the conceptual framework of the text is explicitly stated to be that of an information-processing approach, there are occasional lapses into behaviorism that leave one with an unsettling feeling of having been caught in some peculiar time warp. A notable instance of this problem is demonstrated in the discussion of feedback in instruction, which is unchanged from the 1974 edition. After emphasizing the informational content of feedback as its most critical feature, Gagné and Driscoll proceed to discuss feedback as a reinforcer and then to summarize its benefits in terms of instructional content. Citations of research in this section date from 1965 to 1972. This completely ignores the substantial body of research conducted since 1972 which demonstrates that feedback, particularly in written instruction, consistently violates nearly every characteristic of a reinforcer and that the effects of feedback can only be explained in terms of its informational properties. This chapter cries for updated thinking. If this book is to be used in preparing future teachers, changes which focus on the informational content of feedback and the effective uses of it would be extremely helpful in improving the quality of education.

Any theory or model of learning and memory must somehow account for the process of forgetting. Gagné and Driscoll address this phenomenon in only the most cursory way. A three-sentence paragraph describes fading as a process of forgetting, but the emphasis on age-related fading of memory gives the impression that this is not a process of particular interest to those concerned primarily with younger populations. There is no suggestion that practice might mitigate this circumstance. Two sentences describe interference in terms of confusing older memories with newer ones, and parenthetically suggest that it might erase them. While references to confusion may be theoretically correct, it might be more helpful to those less familiar with IP to explain this explicitly as a process of forgetting. Further, no mention is made of the role of similarity in interference, or that it might either retroactively or proactively affect the memory system. Given this simplistic treatment, an inserted question requesting that the reader generate ways to reduce or avoid interference becomes problematic. These are important principles in the design and implementation of instruction and should be better explained.

Despite some uneven areas, however, it is difficult to think of two scholars better equipped to produce a concise text on learning for instruction than are Drs. Gagné and Driscoll. In updating and improving the first edition, they have produced a book that is substantially improved. This is not just old wine in a new bottle, but a well-fermented, sweet wine with a hint of the bubbly: a must for students of learning theory.—Reviewed by Lou Ann S. Dickson, Arizona State University.
ERlC Reports on ID

Elena D. Beattie
ERIC Clearinghouse on Information
Resources
Syracuse University


The goal of the programmatic research program for the Minnesota Adaptive Instructional System (MAIS), an intelligent computer-assisted instruction system, is to empirically investigate generalizable instructional variables and conditions that improve learning through the use of adaptive instructional strategies. Research has been initiated in the integration of individual difference variables within the student model by extending the learner assessment process to include the cognitive, affective, and memory models, and instructional variables associated with the learning conditions of verbal information and cognitive strategies have been tested.

Two important features of the current version of MAIS are that it distinguishes between individualized instruction and self-instructional teaching, and that it employs a cognitive psychology approach to the selection of instructional strategies. Within the macro or curricular level of the MAIS, variables are defined that relate directly to the concepts of memory and cognition, while at the micro or instructional level, variables are defined that relate to the concept of learning. These two levels interact in an iterative fashion such that the initial conditions of instruction established by the expert tutor model in the macro level adapts at the micro level according to learner progress and needs in learning.

Descriptions of the nine instructional variables that form the possible meta-instructional strategies and a discussion of continuing research directions conclude this paper. Thirteen references are listed. Microfiche 82c, paper copy $1.94, plus shipping, as document ED 285 528.


The first of two papers describes the author's experiences teaching a narrow-cast instructional development course at Indiana University. Among the disadvantages of the experience were the logistics of coordinating the instructional activities between two campuses, additional preparation time requirements, diminished student-teacher interactions, and negative learner attitudes. Advantages included smoother, more effective class sessions; more effective text and graphic visuals; decreased cost; increased course offerings; a more diverse group of learners; and the opportunity to demonstrate the use of an alternative instructional delivery strategy to novice instructional developers.

The second paper describes a study which compared the performance and attitudes toward instruction of 60 eighth-grade students who worked either individually or in two-member teams on a computer-assisted sex education lesson. It was found that learners working together significantly out-performed those working alone, but no significant differences were observed on the attitude toward instruction measure. Mean percent scores for the verbal information and visual recall posttests and for the attitude survey are appended, and three references are provided. Microfiche 82c, paper copy $1.94, plus shipping, as document ED 285 531.


This paper defines a schema as a memory structure representing a general concept and its framework of associated concepts, and identifies the three processes by which learning can occur in individuals whose memories are schema-based, I.e., accretion, tutoring, and restructuring. Ways in which schema might influence instructional design are then discussed: (1) identification of the pre-existing schema before designing instruction; (2) organization, provision of cues, and elaboration to aid accretion; (3) elaboration and practice with a variety of examples to aid schema tuning; and (4) discovery learning through analogy or problem-solving restructuring by schema induction. Ten references are listed. Microfiche 82c, paper copy $1.94, plus shipping, as document ED 285 536.

This discussion of the importance of psychotechnologies such as biofeedback, meditation, and guided imagery to education focuses on the potential of such techniques to expand human learning capabilities and consciousness. The work of many theorists and researchers in the fields of education, physiology, and psychology is reviewed, citing evidence that psychotechnology can: (1) augment instructional design models; (2) generate extraordinary learning outcomes; (3) provide additional cognitive strategies to improve one's ability to learn; and (4) augur a future trend in the definition of instructional technology. A list of 47 references is included. Microfiche 82g, paper copy $1.94, plus shipping, as document ED 285 539.


The effects of various interactive video instructional control options and practice on learning were examined in this study. The interactive video lesson was a 30-minute videotape designed to introduce cardiopulmonary resuscitation (CPR). Subjects were 48 graduate and undergraduate volunteers, none of whom had prior experience with CPR or interactive video. Students were randomly assigned to one of three instructional treatments with the following locus of instructional control versions: (1) designer imposed, following a predetermined path through the lesson dependent on responses to embedded practice questions; (2) learner selected, allowing individual control decisions at certain points; or (3) linear, with no options for control or imposed decisions for remediation or question repetition. A posttest was administered to assess the learning of facts, procedures, and problem-solving skills.

Both the designer imposed and learner selected groups performed better than the linear group, and scores on practiced items were higher than nonpracticed items for each type of learning. These effects were greatest for factual learning and least influential for procedural learning. Supplemen
tal materials include 41 references, sample practice questions, and a graph showing the interaction between practice and type of learning. Microfiche 82g, paper copy $1.94, plus shipping, as document ED 285 541.


The learner's existing schema, which is defined here as an integrated structure of knowledge about a given topic, plays a critical role in new learning. Prior to or during learning, appropriate schemata should be activated in order to produce the best learning results. Instructional designers should systematically assess their target audience's pre-existing schemata and activate them in order to produce efficient and effective learning. Strategies available for this purpose include pre-treatment activities that engage learners in thinking about their existing schema prior to instruction and text enhancement to provide cues in learning material. Metaschemata, or students' knowledge about their own schemata, can be important; researchers have suggested that students learn how to evaluate their schemata and modify them as necessary. A list of 31 references is provided. Microfiche 82g, paper copy $1.94, plus shipping, as document ED 285 548.


This discussion of the implications of schema theory and signaling theory for the design of both paper- and computer-based text describes the macro and micro levels of text structure and their interaction, provides a definition of signaling, and identifies four types of signals: (1) pointer words informing the reader of the author's perspective on a topic; (2) prematurely revealed information previewing content presented later in the text; (3) summary statements restating major points presented in the passage; and (4) words cuing the reader to the relationships of ideas within a content structure. Research on the effects of signaling is then reviewed, and the concepts of schema induction and form schema—i.e., a schema specifying categories of information to be learned—are presented. A summary of some guidelines for computer- and paper-based text display is also provided, as well as a short computer lesson designed by the author to explore possible uses of signals in computer displays. Areas for further research are suggested, and 11 references are listed. Microfiche 82g, paper copy $1.94, plus shipping, as document ED 285 556.


Based on experience and research findings, this paper discusses the advantages of using an integrated computer-based teaching unit consisting of a textbook, educational software, and applications software. It is suggested that the textbook should provide basic background material on the topic, the courseware should be used for simulation, and the application software should demonstrate current applications of the topics studied. A description of the design of such a module for teaching industrial accounting is provided as an example. Four references are included. Microfiche 82g, paper copy $1.94, plus shipping, as document ED 285 473.


Videodiscs have much to offer in developing the school curriculum, but teachers must use definite criteria in planning teaching-learning situations that will enable students to achieve on an individual basis. Thus, students should find meaning, interest, purpose, provision for individual differences, and a balance among objectives in their learning activities. Diverse philosophies of education may be utilized in videodisc technology, i.e., realism, experimentalism, idealism, and existentialism may be stressed as philosophies of education to provide direction and guidance in teaching-learning situations. The psychology of learning also needs to be utilized to assist each student to achieve as much as
possible. Thus, a behavioristic approach and considerable student input in ongoing lessons and units should be used to provide logical and psychological curricula, as well as inductive procedures to lead students to make relevant generalizations, and deductive teaching to assist them in moving from a generalization to its specifics. Microfiche 82¢, paper copy $1.94, plus shipping, as document ED 286 492.


Predicting that the teaching-learning process in American higher education is about to change drastically because of continuing innovations in computer-assisted technology, this paper argues that this change will be driven by inexpensive but powerful computer technology, and that it will manifest itself by reducing the traditional timing of passage through the levels of the cognitive domain. Changes already taking place are reviewed, beginning with the use of the calculator rather than the slide-rule. The impact of computer-assisted technology on the learning/teaching process is then discussed in terms of the cognitive levels specified by Bloom, including knowledge and comprehension, application, analysis, synthesis, and evaluation. Examples are given for each level.

Other topics discussed include problems at the application level; costs; factors involved in the selection of the most appropriate computer systems; copyright protection; data protection; the impact of large, well cross-referenced databases and expert systems on scholarship; local area and other types of networking; and such administrative issues as change of traditional semester times, new disciplines, and changes in testing to reflect the new emphasis on synthesis, analysis, and evaluation that will be made possible by the use of computers in instruction. Microfiche 82¢, paper copy $1.94, plus shipping, as document ED 286 498.


Arguing that goal knowledge is as important to intelligent machine activity as it is to human activity, and that it also must be well understood and explicitly represented in an instructional system if that system is to be successful in fostering learning, this report presents an architecture for intelligent tutors that explicitly represents curriculum or goal knowledge, as well as target (expert) knowledge and knowledge of the individual trainee's aptitude. This is seen to be a first step toward a theory of curriculum that can inform the design of such systems.

The latter part of the report focuses on the concept of "prerequisite," which is the basis for existing computer-assisted instruction; shows how that concept has been inadequate in the past and introduces a new approach, in which the prerequisite relationship is always dependent on the instructional subgoal (curriculum) context. Ten figures illustrate the text and 21 references are provided. Microfiche 82¢, paper copy $5.92, plus shipping, as document ED 289 493.


This report provides information on the background, methodology, and findings of the Videodisc-Microcomputer (ViM) Network project, which brought together over 40 schools in 15 states to explore the potential of a new technology for basic skills instruction. Initiated in 1981 and completed at the end of 1983, the project involved a wide variety of activities, ranging from software development and documentation to equipment acquisition and repair, including on-site and telephone consultations and problem-solving for participating schools and the production of a series of newsletters and a descriptive network directory. Background material provides descriptions of interactive videodisc technology, electronic mail technology, and innovations in the schools. Site selection, overviews of support activities for interactive videodisc and electronic mail, and observations are included in the section on methodology, and the findings are reported under four broad headings: (1) Availability and Durability of Hardware; (2) Availability and Usability of Videodiscs; (3) Needs, Skills, and Time of School Staff; and (4) Communication via Electronic Networks.

Eight appendices make up the major part of the report: (1) Participants in the ViM Network; (2) Sample of the ViM Network Newsletter; (3) ViM Network Directory; (4) Reprint of Articles from Videodisc News; (5) Instructions for ViM-SCRIPT; (6) Example of a ViM Script; (7) Classroom Teacher's Courseware Assessment Form; and (8) Videodisc-Microcomputer Usage Log. Eight references are also provided. Microfiche 82¢, paper copy $15.52, plus shipping, as document ED 288 498.


Many basic skills are chairs of cognitive operations. For teaching such skills, two questions have not been adequately investigated: (1) how the operations comprising the skill should be sequenced, and (2) the relationships among the operations that need to be taught. This investigation entailed four studies on different types and lengths of basic skills in either math or English, and the students were college freshmen. Four types of sequencing were investigated (forward chaining, backward chaining, hierarchical, and elaboration), as well as two types of relationships that might be important to teach (contextual synthesis and performance synthesis).

The results indicate that neither sequence nor synthesis makes much difference for teaching a short skill, but that the longer the skill (or set of related skills), the more difference both sequence and synthesis make. The forward chaining sequence resulted in higher achievement than the elaboration sequence. Based on both theoretical prescriptions and common curriculum sequences in K–12, it is proposed that an elaboration sequence may be effective only for considerably larger chunks of interrelated content (rules) than had been previously proposed, and that within each of those chunks a forward or backward chaining sequence is likely to be optimal. Nine references are provided. Microfiche 82¢, paper copy $11.64, plus shipping, as document ED 288 512.


Arguing that the systematic application of knowledge about instruction to videodisc technology is essential if the
full potential of this medium is to be realized, this paper begins by discussing the need for intelligent videodisc technology in our educational system. A brief review of the state of the art in intelligent videodisc systems, which describes their capabilities and limitations, is followed by a similar review of some aspects of instructional theory that have implications for the design of hardware, software, and courseware for such systems. Some of the problems inhibiting the introduction of videodisc into education are then discussed with emphasis on the lack of sufficient high-quality courseware. Finally, a section on new horizons suggests solutions to these inhibiting factors under the rubrics of general recommendations and recommendations for making better use of present knowledge, for the design of hardware and software, and for the development of instructional models and theories for videodisc systems. A 13-item reference list is provided. Microfiche $2.60, paper copy $3.88, plus shipping, as document ED 288 515.

The above documents may be ordered from the ERIC Document Reproduction Service (EDRS), 3900 Wheeler Ave., Alexandria, VA 22304-5110. Please order by ED number, indicate the format desired (microfiche or paper copy), and include payment for the price listed plus shipping. For VISA or Mastercard orders or information on shipping costs, call EDRS at 1-800-227-3742. Inquiries about ERIC may be addressed to the ERIC Clearinghouse on Information Resources, 500 Huntington Hall, Syracuse University, Syracuse, NY 13244-2340 (315-443-3640).