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ABSTRACT

The first of the two guides presented in this document is intended for preservice and inservice teacher trainers who want to include technology as an integral part of special education training. The guide is divided into five sections. The first summarizes planning issues for university-based programs. The second explores the planning of inservice training programs. The third section describes collaborative efforts among education agencies and institutions of higher education. The fourth section includes planning ideas for individual training events, whether workshops, classes, or seminars. The final section discusses outcomes, including the competencies of training. Inserts throughout the guide provide the thoughts and ideas of experienced trainers. Appendixes include listings of technology competencies for special education teachers used by the University of Kentucky, State of Michigan, and Trenton State College (New Jersey) and forms allowing teachers to evaluate their own technology competence. The second guide offers guidelines for designing any of five types of training materials: authoring courses; desktop publishing; hypermedia; video; computer instruction; and interactive videodisc materials. References accompany each chapter. Also included are lists of trainer recommended software products and training resources in the areas of word processing, desktop publishing, authoring, presentation software, graphics, periodicals, and professional associations. (DB)

Trainer's Resource Guide

Program Planning Ideas

Center for Special Education Technology

A Project of
The Council for Exceptional Children

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Contents

PREFACE

Technology training is a theme for several information activities of CEC's Center for Special Education Technology, a federally funded information center. This document, *Trainer's Resource Guide: Program Planning Ideas* and its companion document, *Trainer's Resource Guide: Training Materials Design Guidelines*, are part of a series of products developed by the Center for Special Education Technology under its technology training theme.

This guide was developed for trainers at both preservice and inservice levels. It includes program planning ideas for use at colleges and universities, as well as state education departments, regional service centers, and local school districts. The guide describes how to include technology both as an integral part of special education training and as a tool in the training process. However, the real value of this document lies in the advice from experienced trainers. They share their thoughts, ideas, and successes or what we refer to as "pearls of wisdom" in the many boxes scattered throughout this guide.

We thank our technology training experts who contributed their ideas to this guide. We thank the following people: A. Edward Blackhurst, University of Kentucky; Gayl Bowser, Oregon Technology Access Project; Amy Dell, Trenton State College; Dave Edyburn, Peabody College, Vanderbilt University; Betsy Knafo, Bank Street College of Education; Colleen Haney, Pennsylvania Assistive Device Center; Alonzo Hannaford, Western Michigan University; Janice Light, Pennsylvania State University; Valita Marshall, University of Missouri-Kansas City; Lucian Parshall, Michigan State Education Department; Eileen Pracek, FDLRS/TECH; Penny Reed, Oregon Department of Education; Herb Reith, Peabody College, Vanderbilt University; Jennifer Taylor, Delaware Learning Resource System; and Joan Thormann, Lesley College.

The Center would also like to thank the review panel members, who provided valuable suggestions throughout the development of both guides: Joan Basile, Georgia Learning Resource Systems; Michael Behrmann, George Mason University; Janis Bing, Texas Education Service Center, Region 6; Kathy Hurley, IBM; Jeffrey Messerer, Northeastern Illinois University; Lewis Polsgrove, Indiana University; Barbara Reeves, Ohio University; and Pamela Ross, INNOTEK.

INTRODUCTION

We live in the Information Age—and the information is constantly changing. Technology has brought an array of new information to the school door. As educators, we must be technologically literate. As self-motivated learners, we must assume the responsibility to seek new information and learn how to apply it to education. Trainers have an even greater responsibility. Both preservice and inservice trainers must ensure that not only are they informed themselves, but also that they inform others. Trainers must move educators at all levels from a basic awareness of technology to higher levels of knowledge, including ways to successfully integrate and apply technology in the classroom. Training must be ongoing, with plenty of follow-up support. With well over 300,000 special educators currently teaching or about to enter the teaching force, it's a formidable task.

The principles for training in the area of technology are similar to those for any training event. However, technology is new to many teachers, and this unfamiliarity often causes apprehension. For example, teachers report that it takes five or six years to feel comfortable and become knowledgeable about using computers for teaching (Sheingold & Hadley, 1990). Even when teachers are trained and feel comfortable with the technology, the information changes and new learning is required. In addition, technology training requires more time to implement, more sophisticated equipment, and more resources than other innovations in education.

The expectations of administrators are high for technology. Administrators want new teachers—from kindergarten through grade 12—to be trained to operate microcomputers (Peyton, 1989). Although Peyton's study found that K-12 teacher recruitment did not depend on teachers' possessing microcomputer skills, it is our belief that when all other factors remain the same, administrators hiring new special education staff will select teachers who are competent in technology use.

The guide was developed to assist trainers in their planning efforts. It provides program planning ideas and concrete examples of how to incorporate technology in the training of special educators. The guide is divided into five sections. The first summarizes planning issues for university-based programs. The second explores the planning of inservice training programs. The third section describes collaborative efforts among education agencies and institutions of higher education. The fourth section includes planning ideas for individual training events, whether workshops, classes, or seminars. The final section discusses outcomes, including the competencies of training.

Experienced trainers share their thoughts, ideas, and successes in the many boxes scattered throughout this guide. The ideas incorporated into this guide are by no means exhaustive. The purpose of this guide is to stimulate thought and discussion among trainers both at the preservice and inservice level. We hope that by sharing the lessons learned from other experts, that the task of training will be made easier. Most importantly, we hope to encourage trainers to infuse technology into their training programs.

References

Peyton, M. (1989). *An identification of the microcomputer skills and understandings needed by preservice teachers.* Dissertation Abstracts.

Sheingold, K., & Hadley, M. (1990). *Accomplished teachers: Integrating computers into classroom practice.* New York, NY: Bank Street College of Education.

INFUSION INTO UNIVERSITY-BASED TRAINING

Many institutions of higher education recognize the need to address technology in their special education programs. Including technology in the curriculum, however, is not always easy for several reasons. First, state mandates often place pressure on special education departments to develop curricula that meet the demands for initial certification. Colleges and universities must determine how to address technology: should it be a separate course, a sequence of courses, or integrated into existing core courses? Many special education programs are crowded with required courses and content that leave little room for additions of any sort. Second, some institutions have a very stable (and sometimes older) faculty that may be resistant to change. In some cases, faculty also require training. Most colleges and universities face the question of how to motivate faculty to incorporate technology into their courses. ("Motivating the Faculty" and "Changing Faculty Activities" below, provide several insightful answers.) Finally, almost all institutions face budget constraints. Funds are not always available for training, equipment, and resources.

Planning a program that includes technology can be divided into five stages. First is an analysis of the current program with an identification of its strengths and weaknesses. Second, planners set goals and structure the overall design for technology inclusion. The development of the program can then proceed. Implementation of the plan is next, followed by ongoing evaluations and revisions of the program.

This section presents several models of technology training at the preservice level. Featured are innovative programs from Trenton State College, Western Michigan University, the University of Kentucky,

Motivating the Faculty

How do we get faculty members to incorporate technology into their courses? How do we overcome their fears, their ignorance, and —in some cases—their hostility? I must admit that I continually deal with those questions. I've found that you need to develop faculty consensus on the integration of technology. You won't be successful until you get faculty members saying, "Yes, we want to do it." To obtain consensus, you need to develop techniques and procedures that will make it easy. For example, I ask students in my specialist training program enrolled in curriculum methods courses to focus their projects on technology applications for that course. Students are encouraged to design and present the information in a modular format that is easy to use. So the next time the course is offered, even if a technology major is not available, the faculty member can implement the module with little effort.

—Mike Behrmann
George Mason University

Changing Faculty Attitudes About Technology

Changing the outlook of our colleagues is essential to the integration process. For the most part, we have not shown teachers and teacher educators the payoff. For many people, getting access to a computer, learning how to use it, and finding the right software are tasks that require significant amounts of time with very little personal benefit. We need to find ways of streamlining the process of integration so busy faculty members can spend less time with technology issues and more time on instructional concerns.

We need to be aware of how technology applications will fit in with what our colleagues are already doing—and will help them do their jobs better. We need to be on the lookout for interesting and new technology applications and say "Hey, does that fit?" and "If so, where?"

For example, if a colleague is teaching communication strategies, augmentative communication is a natural extension. We need to be on the look-out for those course topics in our curriculum that have a logical technology connection. Then the inclusion of technology becomes easy—a natural extension of the course content.

—Dave Edyburn
Peabody College, Vanderbilt University

What we really need to do is make it easier for our colleagues. *We* are the ones who have caught the "bug" and sit and play with all these "toys." When we come across things that would be *really* good—not maybe, not marginally, but ideal—for a course that's being taught, we need to pass them on to our colleagues.

For example, some of the videotapes available from the Pennsylvania Assistive Device Center are outstanding, and they are basically free. So, if one of those tapes is especially relevant to a course that somebody else teaches, lend your colleague that tape, or maybe even give it away. Ask graduate assistants, student assistants, or other knowledgeable personnel to do a computer demonstration. Then the faculty member can present information while the assistant takes care of booting up the software, bringing up menus, and demonstrating programs. In this way, you've made it easier for a resistant colleague to get involved.

—Amy Dell
Trenton State College

Learning a computer application that is personally useful serves the dual purpose of reducing computer phobia and examining one's own learning style. When teachers are asked to analyze their own learning processes as they learn to use a word processor or database, the focus is removed from the technology and placed on the learning experience. Making such connections for themselves is necessary if teachers are to use technology to enhance the learning process for their students.

and Peabody College at Vanderbilt University. These institutions have developed many creative solutions to the problem of including technology in an already crowded curriculum; for brevity's sake, however, we have touched on only a few.

A Starting Point—Trenton State College

How do you begin a technology training program at a small, publicly supported college with limited resources and a strict state mandate on the maximum number of credits (35) for the special education program? In 1988, this college had a special education undergraduate enrollment of 100 and a graduate enrollment of 200 in special education. Unable to add a separate course, Trenton State applied for and received a grant from the U. S. Department of Education, Office of Special Education and Rehabilitation Services, to develop a systematic plan to infuse technology into existing undergraduate courses.

Trenton State Plan for Technology Infusion
(as of June 1990)

Course	Topic of Module	Competencies**
Freshman Year		
SED 101Survey	Technology for People Who Are Blind or Deaf	1.2, 6.2
Sophomore Year		
ICD 240 Computer Literacy	Word Processing for Productivity	7.1
SED 205 Professional Experience	Prompted Writing Programs	3.2
SED 207 Growth & Development	None	
Junior Year		
SED 309 Language Arts	*Introduction to Computer-Assisted Instruction (CAI) Reading and Language Arts	2.1, 2.2.1.
SED 305 Curriculum	*CAI: Subject Software	2.1, 2.2, 6.1.2
	Creating Teaching Materials	7.3
SED 312 Reading	Integrating CAI: Remedial Reading	2.4
SED 320 Mental Retardation	*Miniauthoring programs	2.3
SED 324 Learning Disabilities	Computers as Tool for Writing	3.1, 3.2
SED 322 Multiple Disabilities	*Adaptive Switches	5.0
	*Access to Computers	1.1-1.4, 6.2.1
	*Augmentative Communication	4.0, 6.2.2
Senior Year		
SED 415 Practicum	Determining Students' Technology Needs	1.5, 2.4.2
SED 321 Education	Software for Work & Play (Spreadsheets, Database, Music)	3.4
SED 435 Behavior Management	Data Collection	7.6
SED 498 Advanced Writing	Using Telecommunications & CD-ROM for Research	6.1.1, 6.2.4 7.2
SED 402 Assessment	Assessing Students' Computer Skills	2.4.2
SED 490 Student Teaching	Plan for Classroom Use	6.0

Note: SED = Special Education; ICD = Instructional Computing Development
* These modules are developed and field tested.
** See Appendix A for list of Trenton State College competencies

An analysis of Trenton State's special education program indicated that technology-related topics were randomly introduced, with no sequential building of skills. To systematize the department's plan, the faculty decided to identify technology-related skills crucial for their undergraduates and then infuse these skills into existing courses.

They modified and validated a list of competencies from the University of Kentucky (Blackhurst, 1990) to meet the particular New Jersey state requirements and needs of their students. Next, the faculty matched competencies with core courses. They then assigned technology topics and competencies to 15 of the 16 special education core courses. (See "Trenton State Plan for Technology Infusion" below, for the distribution of technology modules among various courses.) Each year the infusion plan is reviewed and revised as needed.

A series of training modules addressing technology topics and skills is planned for each course. By June 1990, 6 of the 18 modules were developed and field tested. Modules are designed with hands-on experiences. Portions of the content for modules were adapted from other successful training programs. Each module includes competencies, rationale, prerequisites, evaluation, class activities, suggestions for instructor preparation, readings, and student assignments. Module activities vary in length from 30 to 75 minutes and take place over three to four class sessions.

Faculty Productivity: A Solid, No-Frills Approach—Western Michigan University

When change is introduced slowly, there is often a high success rate. Hannaford (1990) describes this as the "snail model," a slow but sure way to bring about change. That premise guided the development of a plan to infuse technology use in special education at Western Michigan University.

Conditions for Successful Infusion

* *Available equipment.* Do what you can with what you have.
* *Trained personnel.* Train them without a great deal of added burden; it's a sell job that takes more than overnight.
* *Time for development.* Unless technology is integrated into what people believe, they won't use it.
* *Accessibility.* Technology must be available when staff and students need to use it.
* *Efficiency.* Technology should increase the efficiency of what you are currently doing; if not, it won't be used.
* *Effectiveness.* Incorporating technology into education should make teachers and students more effective.
* *Utility.* Technology must be used for a purpose.

—Alonzo Hannaford
Western Michigan University

Faced with a stable and older faculty, somewhat resistant to change, Western Michigan University focused efforts first on awareness of technology as a tool to increase the personal productivity of the faculty. Relying solely on internal funding, the university developed a practical plan to do "what they could with what they had." Faculty members were encouraged to take computers home over weekends to become familiar with the equipment. The university found inexpensive ways to release the faculty for training, such as having other staff members cover their classes. Graduate students and part-time aids were available to assist the faculty,

Critical Look at How to Incorporate Technology Into the Curriculum

Six Premises for Technology Infusion

- Bend the technology to fit the objective(s), not the objective(s) to fit the technology.
- Reasons for using the technology must outweigh the reasons for not using the technology—be a critical consumer.
- If you have to "strain" to use the technology to attain a particular objective don't use it—it's probably not appropriate.
- Focus the use of technology—use it for a specific purpose.
- Scratch the learner's itch, not your own—use should be matched to learner's needs.
- Don't duplicate, don't make extra work. If what you are doing works, don't substitute technology---it's nice, but not necessary.

— Alonzo Hannaford
Western Michigan University

troubleshoot, and offer assistance in materials production. Several factors that facilitate the infusion of technology were identified. (See "Conditions for Successful Infusion" above.)

Because of these efforts, faculty productivity has increased; staff members use technology in telecommunications, CAI, spreadsheets, word processing, grading, student records, and databases. Both students and faculty now routinely use technology to assist in the preparation of materials for classroom use. The university also took a hard-nosed approach to determine what role technology play in the curriculum— without forcing technology use (see "Six Premises for Technology Infusion" above). One course in technology is currently offered, with technology-related information infused into other selected courses. More technology content may be added to other courses, but only in a slow, measured way.

A Blueprint for Planning—University of Kentucky

The faculty of the Department of Special Education at the University of Kentucky fully embrace technology. They have systematically infused technology into many aspects of the special education program. Nine core courses, plus practicum experience, address the applications of technology in special education. The university offers three graduate programs (M.S., Ed.S., and Ed.D.) as well as a postdoctoral program for leadership personnel who are interested in developing or improving their technology skills.

The comprehensive model for planning that has been successfully used by the University of Kentucky for more than 20 years to guide special education development was used to design the infusion of technology into the special education programs. This master plan has nine steps (see also "Importance of a Philosophy Statement," below):

1. Develop a mission and philosophy statement.
2. Define the roles and function of future program graduates.
3. Identify competencies associated with each role.
4. Develop objectives and criteria for each competency.
5. Identify, select, or develop content.

Importance of a Philosophy Statement

The first step, developing a statement of philosophy, is important. You need to begin with a well-articulated mission; it provides a conceptual underpinning, if you will, for everything that follows. It should include values and beliefs of the faculty or trainers involved in the design of the inservice program or courses. A mission statement defines what we do, why we do it, and how we do it. In my experience, most curriculum development efforts do not pay enough attention to developing a mission statement. If you don't do this early—particularly with a big curriculum development effort—people working in teams begin to have disagreements and even reach stalemates—and all because not enough attention was paid up front to the philosophical aspects of the design.

Many curriculum development efforts often begin in the middle, by designing the structure of the program (step 6 of the University of Kentucky model). Staff often say, "Well, we need a course in this area" or "We need to redesign this course." But that is an inappropriate place to start. Rather, the information gleaned from the first five steps should precede discussions about what kinds of courses or inservice training you need. Invariably, if you start at Step 6, two years later you're going to say, "Wow, we left a lot of stuff out" or "We've packaged it inappropriately."

— A. E. Blackhurst
University of Kentucky

6. Design structure of program and instructional alternatives.
7. Implement training program.
8. Evaluate training program.
9. Refine and revise program.
10. Maintain management system and conduct formative evaluationg

This model demonstrates how systematic planning can yield a responsive, dynamic, and fully integrated program. Extensive effort went into the development and validation of specific competencies for each program. The faculty developed competencies to meet student needs and to respond to a state mandate for technology competence. Student skills relating to these competencies are assessed with performance-based assessment instruments. These competencies are discussed later in this guide.

Extensions—Peabody College, Vanderbilt University

When technology can enhance effective and appropriate instruction, it is infused into both undergraduate and graduate special education courses at Peabody College. The faculty, the dean, the provost, and the chancellor all strongly support infusion. At the undergraduate level, instruction on principles of effective instruction includes the appropriate use of technology. Graduate-level training emphasizes research on the use of technology as well as using technology to conduct research. Administrators provide support to the faculty by providing resources and by modeling technology use (see "Change as a Process," below).

At Peabody, a contextual framework incorporates the philosophy of all faculty members. Resources funded partly through grant programs provide assistance to instructors who use technology

Change as a Process

* Change must occur as part of a process; technology must serve as a tool to help staff and faculty.
* Personal involvement of the change agent is helpful. As chair, I work with faculty to individually examine courses that can be infused with technology.
* Change must be presented in such a way that faculty have the opportunity to change the model if they choose.
* Change is a continuous process of participation and evaluation. Collect data to see how the program is working and share information whenever possible.
* Strong administrative support is necessary Provide a supportive environment.
* Resources supporting change are needed. Provide systematic instruction to staff and provide equipment resources.

— Herb Rieth
Peabody College, Vanderbilt University

as a part of their instructional approach. Other staff, consultants, and graduate students assist the faculty in the infusion of technology into course content. Other resources allow faculty members to model the use of technology through instructional applications (see "An Example of Support Materials," below).

An Example of Support Materials

Peabody College has found several creative ways for faculty members to model technology use and deliver content at the same time. For example, many faculty members indicated that students at all levels need instruction and practice in writing behavioral objectives. A self-contained unit on this topic is available as an interactive computer-based instructional program. When students need to brush up on writing behavioral objectives, they can work with this program until they reach proficiency.

— Herb Rieth
Peabody College, Vanderbilt

Peabody takes a proactive stance when it comes to technology infusion. Faculty members constantly look for ways technology can serve as a tool to upgrade and update their program. The search is ongoing at faculty meetings, presentations, and workshops. Every semester, a few courses are targeted for infusion. Faculty members are offered a menu of options, which allows them to tailor courses to meet specific individual needs. Options range from low technology support, such as transparency development, to high support, such as videodisc production. No one set of guidelines is presented to the faculty. This approach allows instructors to merge technology use into their courses without the pressure of mandates. When appropriate, they share successful approaches with other faculty.

References

Blackhurst, A. E. (1990). *Planning special education technology pre-service and in-service training* (A presentation handout). Lexington, KY: University of Kentucky, Department of Special Education.

Hannaford, A. (1990). *Infusing technology into special education.* Kalamazoo, MI: Western Michigan University, Department of Special Education, INSTEPP Center.

STATE PERSPECTIVES ON INSERVICE TRAINING

Many people believe that a good training design will accommodate both preservice and inservice audiences. Although this may be true, experienced trainers suggest designing training at the inservice level differently because the needs of this audience are distinct. Teachers at the inservice level have good teaching skills, good grounding in education, and motivation to improve their skills. Teachers who are either not using technology or using it inappropriately usually lack skills and knowledge. Once properly trained and equipped with the necessary resources, most teachers will do their best. However, there will always be a few teachers who are reluctant to use technology. (See "Enticing the Reluctant Learner" below).

When planning an inservice program, a trainer should conduct a needs analysis

Enticing the Reluctant Learner

There are always a few reluctant learners who are not quite ready for technology. We have found several ways to "hook" these teachers. First, we attend educational conferences that typically do not offer sessions on technology. Instead of making formal presentation we set up a table in the hall. The tables are equipped with computers and printers with colored ribbons. We use some type of print program such as *Print Shop*, *Garfield*, or *Certificate Maker*. Our staff wear blinking buttons to attract teachers. As teachers move from session to session we encourage them to stop and make a card, certificate, banner, or whatever they want. In ju short amount of time they have a finished product to take home, and they have found that technology is not that difficult to use. We give each teacher a bright fluorescent sticker that says, "I did it at the Make-n-Take." We have "hooked" more teachers on technology by this approach than any other single activity. We call this the "Electronic Make-and-Take Strategy."

Because it is impossible to reach everyone at these conferences, we use a similar strategy at the local level. FDLRS Centers may set up a table for a day in a media center or teacher's lounge located within a school. This gives teachers an opportunity to stop by during a break or after school. We try to show teachers how technology can assist them as a teaching tool or how it can be incorporated into content areas and give them an opportunity to copy public domain software. For example, with the recent move toward whole language we have teachers making their own big books.

Some FDLRS Centers also work with schools to provide a substitute teacher on the day they visit their media center. This provides release time for teachers so they can spend more time with the technology opportunities offered in the media center.

—Eileen Pracek, FDLRS/TECH

Training the Trainers

- Network training should model best practices.
- Training and resources for training should concentrate on technology topics that are critical to exceptional education.
- When building skills, training should always be hands- on.
- Specific resources needed for duplicating training should be provided to FDLRS centers.
- When resources are provided, FDLRS centers should make a commitment to use them by implementing training, establishing demonstration classrooms, and/or by developing products to be used by all centers.
- Whenever possible, network training sessions should coincide with other activities to make maximum use of resources.
- Target groups for network training should include core trainers and, depending on the topic, other related personnel.
- Successful practices from district training sessions should be identified and shared.
- Successful practices from other state and national projects should be identified and shared.
- Summer institutes should be held each year to deliver intense training in identified areas of special need.

—Eileen Pracek, FDLRS/TECH

of the audience. Training programs should address the various levels of technology skills and knowledge of participants. Frequently, inservice is a one-shot deal. However, if long-term gains are to be made, teachers must be offered ongoing training, with ample hands-on experiences and follow-up support.

Inservice training usually takes place within the context of an education agency at the state, regional, or local level. The variables for each setting are different and affect the final design for training: the number of requests for training, staff members available to provide training, the time to present and learn new technology, money to purchase resources, and the willingness of staff to learn new practices. Moreover, some training programs should be individualized to provide direct training in certain adaptive devices that become available to a school or an individual student. For more discussion on this topic, see the section, "Planning for Individual Training Events" on page 23.

This section presents five inservice models from Florida, Missouri, Michigan, Oregon, and Massachusetts. Like preservice efforts, these models vary in their design. Although this section focuses on state-level inservice models, parts of the models are appropriate for local efforts.

A Statewide Network—Florida

In Florida, training personnel who work with exceptional students is one of the functions of the Florida Diagnostic and Learning Resource System (FDLRS), a statewide network of 18 associate and 10 specialized centers. Since 1974, FDLRS has served as a support service to exceptional student education; it has received federal and state funding to provide training and other resources since 1983.

Operating out of the Brevard County School District, FDLRS/TECH is designated as an Instructional Technology Training Resource Center to assist the FDLRS centers in delivering technology services to all school districts in the state. Specifically, the Tech Center assists personnel in acquiring and maintaining required skills and provides resources for training. The Center designs training programs for teachers, administrators, parents, and other related personnel.

Since statewide training opportunities are limited, it is critical that training be effective and delivered in a manner that optimizes available resources. The "training the trainers" model best meets the need for a statewide delivery system in Florida. Instructional technology contacts in each of the FDLRS centers serve as the initial core of trainers.

Effective use of technology in the curriculum requires the expertise of content personnel as well as experience in using the technology. Engaging experienced teachers as trainers of other teachers expands both the resource and the knowledge base. In order to assist trainers in delivering quality training to districts, those providing "training for the trainers" established criteria for statewide training. (See "Training Trainers" above.)

Training content and skills for teachers and other personnel at the district level are grouped into eight broad categories:

- Computer literacy for the special education teacher.
- Selecting software for the special education student.
- Integrating software into the special education curriculum.
- Computer awareness for the special education parent.
- Adaptive/assistive devices.
- Tools for the special education teacher.
- Tools for the special education student.
- Policies, issues, and trends.

In a concentrated FDLRS network effort, replicable workshops were developed in each of these categories by trainers who are experienced in meeting the needs of exceptional students and who know the technology. Workshops are documented in an easy-to-duplicate format. All the required information is available or easily accessible. These materials offer a viable alternative for delivering effective training to individual school districts.

The FDLRS system also developed a module that introduces parents to the potential of technology in aiding their children. Parent training is offered through FDLRS associate centers and as an option at meetings and conferences that parents attend. Parents preview software at each FDLRS center and may copy public domain software for use at home.

A Centralized System—Missouri

With a large rural population, Missouri established a centralized, collaborative network to provide technology training. The Missouri Technology Center for Special Education is funded through the Department of Elementary and Secondary Education, the Division of Special Education in cooperation with the University of Missouri at Kansas City, School of Education. This center serves not only the state's school districts, but also it's institutions of higher education and state schools.

The Missouri Technology Center offers several types of training activities—which are in-depth, hands-on experiences—to administrators, teachers, and university faculty members:

- Regional workshops are all-day training experiences presented throughout the state. Although labor intensive, these workshops are worth

Planning Workshops

We have developed several prepackaged workshops, from basic general awareness overview training to highly specific, hands-ons training such as programming augmentative communication systems. We target at least six different sites in the state every academic year.

Each workshop is approximately one day in length. We have designed rather extensive workbooks to accompany the training, since we have found that the participants can retain only so much information during information-packed workshops. Print materials are critical because after the workshop is over, participants have them for reference. They do not have to rely just on their notes or on what they remember.

In the past, our training opportunities were free of charge. But Missouri faced a budgetary crisis two years ago, and we decided to charge for our services. We kept fees nominal so many rural districts could afford to send someone for training. For regional training we charge $25 per participant for an all-day program. For district training, we charge the district $75 for the whole day regardless of how many participants attend. Our objective is not to make a profit, but to have partial cost recovery. It is interesting to note, however, that participation has increased in the past two years. People seem to value those things they pay for.

Another change that has made our training more effective is to move the sessions out of the schools. Schools are just not an effective place to train teachers. There are too many bells going off, teachers and students moving around, and other distractions. The teachers can't concentrate. We use the conference rooms of a hotel near the school. Our sessions run from 9 a.m. to 4 p.m., with an hour for lunch. Teachers consider the lunch break a real benefit, because they're not used to that hour in their regular school day.

We bring all our own equipment to the hotel. It was a bigger nightmare trying to use equipment from the schools—their computers didn't have enough memory, and printers wouldn't print. When we schedule for the year, we try to give ourselves at least a month between regional training sessions to allow for staff recovery from moving everything—12 computers, extension cords, surge protectors, printers, and other equipment.

We allow only two to three participants per computer if we're doing hands-on training. We've gotten very fast at dismantling and reassembling. We know exactly how we want the room set up, and the hotels have always been extremely helpful.

— Valita Marshall
Missouri Technology Center for Special Education

Effective Training Procedures

The Missouri Technology Center has several suggestions to increase the success of training activities. They discovered that methodical planning and preparation pay off with motivated participants who receive the information and skills they need:

- Begin each training session with an advanced organizer that includes a promise of the material that will be covered. Then fulfill the promise. Supply bibliographic information for advanced learning should the participants desire.
- At the beginning of a session, ask each member of the audience to think of a particular student with whom to use the training information.
- Identify the needs of your audience. Then ask them what their level of experience or knowledge is related to the topic. Be aware that the audience does have knowledge and experience that can enhance your presentation, so encourage active participation.
- Address each question posed from the audience with respect. If you cannot answer a question, then **follow up** through additional correspondence.
- Create an environment in which participants can express themselves and share personal experiences in a nonthreatening manner.
- Share your **failures** as well as your successes.
- Limit the size of your audience whenever possible (25-35 is a good size for group participation).
- Know your topic inside and out. Then, should the need arise, you can modify to meet the audience's needs.
- Invert the learning pyramid—start with a narrow focus, then add to this to develop a broader application of the information provided.
- Arrive early for your presentation, and always be prepared for equipment failure. Bring backups whenever possible, and have an alternative presentation plan should equipment fail. Audiences become restless if forced to wait while presenters "futz" with equipment.

— Valita Marshall
Missouri Technology Center for Special Education

the effort as they provide in-depth training to special educators, as well as training materials for the district's continued use.

* At district inservice programs, topics are normally more specific to the needs of a particular district.
* At statewide conferences, Center staff offer direct training to a large number of special educators; and the conference schedule includes both exhibits and demonstration of different types of technological devices.

The Missouri Technology Center has learned from experience how to plan for effective workshops. (See "Planning Workshops" above, for a good look at their planning; also see "Effective Training Procedures" above, for some specific training hints.

Training and Change

- Change is a process, not a single event. As such, it must be facilitated by a multidimensional effort.
- As teachers move through the change process, they will go through predictable stages of adoption.
- Support must come from locally based resources, where they are readily accessible to the educators using the technology.
- As an agency moves from simple awareness to actual integration of a new technology or practice, ongoing support is vital.

— Lucian Parshall, Special Education Services, Michigan Department of Education

A State Plan—Michigan

Knowing that change is more successful when those affected are involved in planning, innovators in Michigan formed a task force that included key special education organizations, universities, vendors, and rehabilitation services. Representatives of these groups developed a long-range technology plan for Michigan's Department of Special Education. They identified the steps needed to ensure full use of technology in special education, and using state discretionary and some Part D funds implemented the 5-year plan.

Long-range goals encompassed four areas: computer-aided instruction, computer-assisted management, adaptive devices, and emerging technology. A list of teacher and administrator competencies also evolved. The task force addressed each goal in the plan through personnel preparation; software development; mini-grants to purchase hardware and/or adaptive devices; and two statewide clearinghouses: the LLRC and ACCESS.

Perhaps the most impressive result of this planning process was the function the task force performed after completing the state plan. Having discovered common interests and concerns relating to technology in special education, the task force remained together. The members, who represented over 15 organizations, realized that they had a responsibility beyond the plan to promote a more systematic use of technologies. The task force organized and developed a set of by laws and, in 1985, formed, the Coalition of Organizations in Michigan to Promote the Use of Technology in Special Education (COMPUTE).

This coalition then continued to refine the competencies included in the state plan and developed several training modules. One of these is an introductory, 2-hour workshop. Other programs include 5 comprehensive training modules on general technological literacy, instructional software, evaluation, adaptive devices, and directed experience.

Each module includes all elements necessary for effective training: an overview, prerequisite skills, competencies, training objectives, learner outcomes, required materials, teaching outline, handouts, transparencies, a self-evaluation form, study guides, resources, and an overall evaluation form. Modules initially were not available for general dissemination without appropriate training. Later, COMPUTE used a train-the- trainer approach for both preservice and inservice partici-

pants. A total of 800 to 900 teachers are trained each year using this approach (see "Training and Change," above).

COMPUTE also supports its member organizations within the coalition through such activities as computer laboratories at annual conferences, software demonstrations, equipment loans, and general assistance in planning and conducting training workshops using the modules.

Strengthening Training Efforts: Empowerment of Teachers— Oregon

Once a state has a plan for technology training, how do planners entice teachers and other school staff with limited funds to attend training? How do they ensure long range commitment? Two states, Oregon and Massachusetts, have similar solutions.

Oregon's Technology Access Program conducts resource development and in-service training for teachers, therapists, administrators, and parents throughout the state. The program has three goals:

- Infuse technology into existing systems.
- Develop technology competencies for educators and parents.
- Provide resources and training materials for teachers.

Rather than using technology as a separate goal area, the program tries to infuse technology use into areas such as transition, supported education, low-incidence populations, or family support. These efforts are focused at local, regional, and state levels. Training goals are based on several premises; the most important is that of empowering a targeted group of educators and parents. This means that these individuals must acquire the tools, knowledge, and resources to continue their efforts (see "Empowerment of Technology Users," below).

By including technology into all state plan goal areas, the access to various populations has increased. Coordinating training activities with other state agencies such as the Vocational Rehabilitation Division is one successful way to share limited resources and personnel. Oregon finds that collaboration has occurred more frequently since they established a Technology Center under the State Tech Grant (P. L. 100-407) program. Although

Empowerment of Technology Users

- Give technology users the tools for empowerment— training, resources, time, support.
- Recognize that technology users are competent in many areas.
- Remember that poor functioning in the use of technology is usually due to lack of information and resources.
- Acknowledge that if technology users are not doing a good job, it is not because they can't but because they need additional resources or support.
- Expect that technology competencies can be acquired when needed.
- Ensure that technology users play an active role in planning and acquiring the competencies they need.

— Gayl Bowser,
Oregon Technology Access Program

still at the awareness level, the Oregon Technology Access Program works closely with their state Crippled Children's Programs, State Schools, Disabilities Commission, Early Intervention Program, and Developmental Disabilities Council for some training activities. Not only does this approach share resources, but also allows others to see the potential of technology and increases the likelihood that technology will be infused in these programs.

A regional train-the-trainer model is used to train teams, which may consist of teachers, physical therapists, occupational therapists, vision and hearing teachers, and speech/language pathologists. Regional teams are empowered with resources, such as short-term loan equipment for evaluation purposes, a lending library of commercial software, public domain software, training kits of hardware (e.g., kits equipped with 10 of everything—adaptive firmware cards, echo speech synthesizers, etc.) and training materials. This strategy develops a network of em-

A Follow-Up Strategy

The Oregon Technology Access Program offers several special summer institutes that are highly effective. Last summer, a third-party evaluator found that over 90% of the participants reported that the training resulted in significant changes in their practice. Several strategies help make these institutes a success.

- Before acceptance to the training, educators must obtain their supervisor's permission to attend.
- The supervisor must agree to allow time for the educator to implement content learned during the institute and provide the necessary support to do so.
- Participants, trainers, and supervisors agree on a follow-up plan.

All participants attending a summer institute must complete a goal statement before they leave the training. The trainer reviews the plan with each participant to ensure that it is a realistic goal. Participants may write goals that involve working with a particular student, training someone else in their building, or contributing to their own growth and development.

Some will put more emphasis on one area than another, but they are expected to write between two and five goals. They are asked to indicate the resources needed—what's available as well as what they will need to acquire. Goals that involve purchasing additional equipment, are not accepted unless the district has already committed to the purchase, because equipment purchase is a problem in many school districts.

Completed plans are sent to the supervisor who must approve the plan in writing. There is a place where supervisors can change the plan if there is something written that they feel cannot be implemented. The signed plan is sent to the trainers by the end of September. During the school year, participants are periodically contacted to check the progress of their plans.

— Penny Reed, Oregon Technology Access Program, Oregon Department of Education

Successful Strategies to Strengthen Training Efforts

Though all our efforts were strictly low budget, several strategies seemed to increase our success. Entrance into the special seminars was a competitive process. To attend the seminar, teachers had to complete an application form and obtain their supervisors' support. There were a limited number of slots for training—20 in each region.

When the seminars were completed, teachers received a stipend of $250. This was basically to pay them for attending the sessions and for writing an article and a lesson plan. Although this was not a large sum of money, it did provide recognition to the teachers for their efforts. Teachers and their schools received additional recognition when the articles were published in the newsletter. We had a subscription of about 2,000. I selected teacher's articles that were very practical—ones that include what teachers could do in their classroom.

The newsletter articles proved to be effective public relations. Not only did the teachers feel good about being published, but they received local recognition. We sent multiple complimentary copies to the superintendent, special education director, and other individuals for them to distribute, making them aware of the participating teachers' accomplishments. The seminars opened the door to leadership opportunities for these teachers farther down the line.

—Joan Thormann
Lesley College, Massachusetts

powered trainers who can infuse technology from their particular discipline into their geographic location.

At the local level, the major goal of training is to infuse technology into existing curricula. Inservice training emphasizes application of technology and specific skill development. Competencies for this training are identified by local learners and are developed specifically for the group receiving the inservice. The local group plans all inservice programs at this level. All materials and resources developed focus on the use of technology as a tool (see "A Follow-up Strategy," above).

Strengthening Training Efforts: Incentives—Massachusetts

Massachusetts focused its technology training into three areas: seminars on the use of computers in special education, a summer institute that was a federally funded project, and a statewide newsletter. Although these projects no longer exist due to lack of funding, they were highly successful.

The purpose of the regional seminars was to increase the use of computers with students with disabilities. Trainers offered programs for both regular and special educators in each of six regional areas. Twenty experienced teachers attended each regional training program. Training was conducted every other week for a total of six sessions, 2 1/2 hours each. When these teachers completed the program, a ripple effect was created. Participants were asked to disseminate and share information with other people in their district or area. They did this by conducting at least one inservice program in

their home district, developing lesson plans that were shared with the teachers in their region, and writing an article for the state newsletter (see "Successful Strategies to Strengthen Training Efforts," above.)

The two-week summer institutes followed a similar format, except that 20 experts and 20 novices were invited to attend. As with the seminar, participants agreed to conduct an inservice workshop in their districts and write an article for the state newsletter. The summer institute was different in that some trainers outside the state department were used. In addition, a close collegial atmosphere was fostered by the intensive residential format, and teachers learned a great deal from each other, as well as, faculty.

COLLABORATION BY CONSORTIUM

Perhaps one of the most exciting developments in technology training is the movement of state education agencies (SEAs) and institutions of higher education (IHEs) toward collaborative training efforts. Both groups realize the value of working together for a smooth transition of skills from one level to the next. They also recognize the benefits of sharing knowledge, expertise, and resources. Collaborative efforts in Pennsylvania and Michigan highlight how this can be done.

Pennsylvania Consortium

Pennsylvania has just begun a consortium of SEA and IHE members, though educators from this state long ago recognized the need for collaborative efforts. Early collaborative attempts of the Pennsylvania Assistive Device Center were met with some interest, but there was no sustained commitment. In 1990, however, the Pennsylvania Assistive Device Center, Pennsylvania State University, and Temple University established a formal, successful collaborative effort to address training needs.

These three groups identified a number of common problems and concerns: a paucity of trained professionals in the areas of augmentative communication and assistive technology, a lack of appropriate inservice and preservice trainers, and an absence of communication among groups. There was little coordination between the SEA and IHEs in their efforts to address these problems.

A survey was mailed to all the universities in Pennsylvania to determine the level of interest in the area of assistive technology and the current status of efforts in this area, including the instruction offered and research and clinical services provided. Results of the survey were disseminated to the SEA and IHEs. An audio conference in October 1990 formalized the collaborative network, established goals, identified tasks and roles, and established a communication link.

The consortium established four subcommittees to address research, competencies for professionals, curriculum, and state reform. Additional conference calls and in-person meetings will continue to foster the consortium. All groups are excited at this new prospect and stress two key points: the involvement of key players with links to the SEA and the IHEs and the philosophical belief that two-way communication is beneficial to all. Long- range goals include an increase in the number of trainers and trained professionals in the areas of augmentative communication and assistive technology, increased research efforts, state reform, and development of professional competencies and related curriculum. Additional information and survey results are available from the Pennsylvania Assistive Device Center.

Michigan Consortium

The Special Education Services (SES) area within the Michigan Department of Education continually collaborates with its 13 universities and colleges that provide preservice programs in special education. This step was needed because in 1987, the state revised its certification rules to require university graduates to demonstrate competence in the area of adaptive devices. Furthermore, a state-

ment was added to its rules addressing the use of adaptive devices in the individualized education plan. These requirements underscored the need for technology training for both undergraduate and graduate students in special education.

More recently, Michigan began developing 12 guides that identify the outcomes that students with disabilities should attain when they exit special education. Each guide is developed for a specific disability group (visually impaired, emotionally disturbed, etc.) Although not technology specific, the guides also contain information pertaining to the need and use of technology. A half-day workshop was held with 13 state college and university trainers to explain the outcome guides. Many faculty members have adopted the outcome guides as textbooks. The SES has found that by providing its IHEs with prepared materials and assisting in training efforts, it encourages change at the institutions and ultimately produces more knowledgeable teachers for the field.

PLANNING INDIVIDUAL TRAINING EVENTS

Research is sparse in the area of designing inservice training events that are specific to computer education (Moursund, 1989). No one yet pretends to have discovered all the elements that make staff development programs completely successful (Gall & Renchler as cited by Moursund). This section will discuss those factors that seem to be necessary for conducting successful training events.

Audience

The first step in the effective design of training is to define the audience and identify its needs. Trainers should be sensitive to what participants already know, as well as to their current concerns (Hall and Loucks, 1980).

Tips to Guide Training

FDLRS/TECH uses the following premises to guide training efforts and development:

- Teachers generally prefer hands-on instruction; use it whenever possible.
- Use simulated experiences to help people understand the need for access to technology.
- When delivering training, maintain a balance between emphasizing the effective use of older available technology as well as they new state-of-the-art technology. This avoids frustration.
- Remain on the cutting edge so people know what to reach for—they need a vision.
- Link technology not only to curriculum content, but to curriculum trends; for example, model the use of technology with a whole language approach.
- Use the research results in developing training which will appeal to all types of learning styles and intelligences.
- Take what you know from content research and use it to set up a model training program.
- Make sure you are involved in other planning efforts (e.g., state, district or local level); invite yourself; be brave.
- Go where the money is. Look at future state and local priorities. Focus your efforts on those priorities.
- Educators learn best from other educators who have demonstrated success with the training content. Use peers to train whenever possible.
- Research shows that gains are made when you have a mover and shaker in every building. Train to that end.

—Eileen Pracek, FDLRS/TECH

Integrating Technological Competencies

Several questions need to be considered when you try to fit competencies into existing courses. Sometimes the answers are clear. For example, at Trenton State, the course on multiple disabilities is a second-emester, junior-level course. Before we were involved in technology, that course already covered augmentative communication as a topic—introducing manual communication boards, eye gaze techniques, and scanning devices, as well as issues that relate to how an augmentative system is chosen for a student. It was natural to add computerized augmentative communication systems. The new technologies are certainly more sophisticated and involved, but they still are augmentative communication. It made sense to take the competencies related to technology in augmentative communication and insert them into a course on multiple disabilities.

In the same course, another major topic was adapting materials and environments so that students with multiple disabilities can participate in daily activities. It was not a big stretch to add adaptations that are needed to provide access to computers. These are two examples of where technology competencies fit smoothly— although it is difficult to fit all needed skills into just one course.

Another question is the sequence for introducing the competencies. One of the strange things you'll notice in our plan for infusion (see "Trenton State Plan for Technology Infusion", in the first section of this guide), is that the student's first introduction to computer-assisted instruction (CAI) is in a reading and language arts course, because that is one of the first special education courses the students take. This infusion actually has worked out well. We introduce drill-and-practice and game software that relates to reading; and the following semester we introduce other subject-matter software. That, in a nutshell, is how we infuse competencies into core courses.

— Amy Dell
Trenton State College

When asked how to integrate technology competencies into an undergraduate course, I invariably answer that it depends on the course and the particular instructional objective. The goal of integrating technology into a course depends on using technology well, not to computerize the whole course. For example, if I'm teaching a behavior management course, I may consider looking for software that will enable me to monitor students' academic performance or enable students to monitor their own performance, build students' skills in conflict resolution, or engage student's in cooperative problem solving. I select the most important objectives and look for appropriate software.

When it comes time to use the program within the course I could make it a class activity (demonstrating the program or simulating its use), make it available in a computer lab for an out-of-class assignment, or have a group of students use it and report back to the rest of the class as part of a special project. The choice of technology depends on the match—where it fits and how much time you can allow, based on how good the match is. The ultimate criterion of success is focused on whether or not technology has enhanced teaching and learning.

— Dave Edyburn,
Peabody College,
Vanderbilt University

Because teachers play a critical role in the use of technology, they should have an opportunity to identify their training needs (Glenn & Carrier, 1987). By conducting a needs assessment, trainers can easily determine the needs and levels of expertise of participants. This simple process provides teachers with the feeling of ownership—which Moursund (1989) defines as a deep interest and involvement with a situation that often contributes to deep and lasting learning and intellectual growth. (See "Tips to Guide Training," above.)

Topics, Goals, Competencies and Objectives

The next several steps in designing training sessions include identifying the topics, goals, competencies, and objectives. Each step needs to be given careful thought. Every session or course needs to have a general topic and specific goals, competencies, and objectives. In addition, the long-range goals of the training institution are of primary importance. They shape all training events. At the preservice level, this is a crucial process. If technology is to be infused into all special education core courses, educators must develop a systematic process to ensure

Structured Lab Time

In a graduate special education program like ours, most students are professionals already working in schools. These students, unlike undergraduates, have a limited amount of time to spend on technological lab assignments. I found that I have to build structured lab assignments into my class time. In one case, I've turned a 3-hour course into a 4-hour course. I schedule it from 4:30 to 8:30 p.m. so that all students have time to participate. Half of that course is hands-on technology training. You may need to make different arrangements, but whatever you do, structure the lab assignments.

— Mike Behrmann
George Mason University

A Continuum of Training

I operate two state-funded technical assistance centers that reach about 1,500 teachers a year in northern and northwestern Virginia. About half the training is technology related. We've found that we need to provide a complete continuum of technical assistance training—everything from one-hour and full-day workshops to individual and small-group training sessions. We hold most workshops and individual training sessions at the university site, but we also provide many small-group sessions, and individual consultations in teachers' classrooms, as they work with their kids.

We originally thought that we would teach some basic computer literacy, and then we could move on to more advanced skills, but that's not always possible. It's important to provide ongoing assistance.

— Mike Behrmann
George Mason University

that all competencies are addressed. As we discussed previously, Trenton State first listed all the core courses, then assigned each course a topic and related competencies (see "Trenton State Plan for Technology Infusion", in the first section of this guide, "Infusion into University-Based Training", see also "Integrating Technological Competencies," above).

Prerequisite Skills

Identifying the prerequisite skills for a particular training session helps to determine the order and sequence of training events. For example, the prerequisite skills for the workshop on Developing Customized Scans with the Adaptive Firmware Card are (a) to know how to install, format, and use the Adaptive Firmware Card and (b) to know how to use the Echo Speech Synthesizer. These skills must be taught to participants who do not demonstrate competence before this session can be offered. The same process is used for college courses.

Length of Training

Learning how to use technology takes time, often more than a university or education agency has. As we have stated previously, successful technology training needs to be more than a one-shot experience (Glenn & Carrier, 1987) (see "A Continuum of Training," above).

Technology training should be an ongoing process that is addressed throughout the school year or semester. The length of each session also needs to be determined. Will it be 1 hour, 90 minutes, one afternoon, or all day? For sessions longer than an hour, trainers should pay careful attention to methodology.

Trainers should also consider how to fit in the time necessary for participants to

Color Coding for Ease of Use

The trick is to develop systems that make it easy for the teacher. For instance, we've color coded the software. Students and teachers match the yellow dot from the software to the yellow dot on the power pad and to the yellow dot on the computer that's set up for the power pad. Developing techniques that make life easier for teachers is really important.

—Mike Behrmann
George Mason University

Multi-day, Follow-up Training

We promote multi-day training. In the past we've held a variety of inservice workshops, from half-day to whole-day, including retreats. We've found that our participants have the best success when we schedule multi-day training with follow-up sessions or visits by ADC staff to their classrooms: we go back in 6 weeks, then after 2 more months, and then after another 6 weeks. We meet with teachers continually, upgrading their skills, checking with them, and helping them out. That's how we're going to target our training in the next year.

— Colleen Haney
Pennsylvania Assistive Device Center

Locating Resources

Don't worry about the "platform" or computers that you're using. Use what you have access to. Use the platforms that provide generic types of experiences with the technology. Technology is changing so fast that even if you have access to the most modern, up-to-date computer, it's out of date next week. You need to teach people how to integrate and use the technology, not how to use a specific piece of software or a specific type of computer.

Manufacturers often have developed videos that they will lend. I've been creating my own library by collecting a number of different videotapes on assistive technology and other technology. The Pennsylvania Assistive Device Center has also provided us with many training tapes.

— Mike Behrmann, George Mason University

When asked how to begin a program with little or no equipment, I reply that we began with one computer. One computer these days is really not that expensive. Sometimes you can get another department's castoff computer and start with that. Later you can write for grants to supply a few software programs or a couple of assistive devices. You just don't get a $100,000 grant and order everything all at once. It just grows—very, very slowly.

— Amy Dell, Trenton State College

learn a skill (see "Structured Lab Time" above, and "Multi-day, Follow-up Training", above).

Key Points and Activities

Outlining key points and activities puts the content of the training session on paper. It need not be a verbatim account of what will be said, but merely an outline of major points to jog the trainer's memory. Identifying necessary materials and equipment required for training is essential. First, it helps to organize the training before the event. Second, it identifies the basic equipment a trainer must have before training can occur.

For example, if 10 multiswitch boxes are necessary and are unavailable, then either the training session must be modified or postponed, or equipment must be purchased or borrowed. If training is not conducted at the home site,

Low-budget Materials

Our goal is to acquire a complete collection of public domain software for the student with disabilities and for the classroom teachers of students with disabilities. We want the teachers to come and have a hands-on training workshop in public domain software. Unfortunately, due to budget and time constraints, this is not always possible.

A practical alternative is an awareness slide show, which was funded by a grant of $1,000. This grant enabled us to create a professional slide show of relevant photographs. So if teachers can't come to us, we go to them. We'd love to have a video show, but we make do with slides. We also take some of the critical equipment for a hands-on demonstration.

— Jennifer Taylor
Delaware Learning Resource System

such a checklist ensures that you bring everything or the people at the host site have acquired the necessary materials and equipment.

Materials and Resources

Trainers at both preservice and inservice levels should take great care in the design of handouts, transparencies, CAI programs, videotapes, and videodiscs. Steps critical to the effective design of these materials are discussed in the companion document, *Trainer's Resource Guide: Training Materials Design Guidelines*. Above all, the final design needs to be in a format that encourages use. Sometimes you need additional strategies (see "Color Coding for Ease of Use" above).

Many times the lack of equipment or resources inhibits the training plan. However, many vendors are willing to lend equipment at little or no cost (except for mailing costs). Software vendors are often generous at providing software on a 30-day preview basis. But the lack of resources should not thwart your efforts. You have to start somewhere (see "Locating Resources," above).

Although everyone wants equipment and resources that are well designed, budgets often impose limitations. Solutions to this dilemma are often surprisingly simple (see "State Perspectives on Inservice Training" and "Low-Budget Materials," above).

Adult Learner Characteristics

When designing programs for adults at both preservice and inservice levels, trainers must pay attention to the particular learning styles of adults. Moursund (1989) has consolidated Knowles (1978) work on guidelines for training adult learners (see "Training the Adult Learner," above).

In addition to considering particular training needs of adult learners, trainers should determine the skill levels of the participants. Not only have Glenn and Carrier (1987) identified different content for the novice and expert learner, but they have identified different teaching strategies for both, as follows:

- Strategies for the novice include highly structured sessions with cycles of preinstructional, instructional, and postinstructional activities; an emphasis on teamwork, supervised individual exploration time; and follow-up activities. (For other successful instructional strategies, see "Instruction for the Novice," below. Although preservice strategies are discussed, they are appropriate for any level of instruction.)

Training the Adult Learner

Here are some important issues in teaching adult learners:

- Adults learn by doing. Involve them—demonstration alone is not enough. Add practice and guided practice, and provide many opportunities.
- Problems and examples must be realistic and relevant.
- Relate their learning strongly to what they already know.
- Adults tend to prefer informal learning environments, which are less likely to produce tension and anxiety.
- Change the pace and instructional methods to keep the interest high.
- Unless absolutely necessary, avoid a grading system; use checklists of criteria.
- The instructor should frame his or her role as that of a facilitator of learning.

— *Moursund (1989)*
Knowles (1978)

Instruction for the Novice

Our technology modules for undergraduate training have two major characteristics. The first is that they must involve practical, hands-on experiences. Depending on the topic, the hands-on activity might be an in-class workshop or an out-of-class assignment. Stuents might work in small groups or individually. In some cases, they have access to computers in round-robin fashion. The guiding principle is that the hands-on experiences must engage and captivate the learners. Students are not allowed to hide behind passive notetaking. Instead of just listening to information about the different adaptations that are available, students are actively involved.

A second characteristic of the modules is that they must emphasize decision-making activities. It's both easy and tempting to focus training on the razzle-dazzle of new assistive devices, bu we need to ensure that the end use of technology is never lost. There must be a match between what a person with disabilities needs and what is available. Many assignments in our modules begin with the phrase, "Select a person." The student then progresses through a decision-making process, analyzing the needs of this person, what he or she needs to be taught, and which teaching methods and materials should be used. The decision to use a particular miniauthoring program or to customize a piece of software is part of the decision-making process.

—Amy Dell
Trenton State College

* Strategies for the expert include peer teaching, practice in training other teachers, projects that demonstrate the application of effective instruction principles, assigned readings in the area of effective teacher behavior, instructional design, computer-based instruction, and follow-up activities.

Size of Training Group

The size of the training group is crucial to the effectiveness of the training. Traditional training usually involves large groups; but, it is very difficult to provide informal, "hands-on" experiences to a large group. Training sessions should remain as small as possible. Ideally, for example, there should be no more than three participants per computer. Instructors should try to limit the class size, use grouping techniques, or require lab assignments with individualized instruction.

Moursund (1989) believes that the most effective inservice program is on a one-to-one basis, teacher to teacher. This could be easily accomplished by training a cadre of technology experts, who then train more teachers, and so on. Unfortunately, he concludes, this situation does not exist in very many schools; and the more traditional, large-group inservice instruction will likely continue for many years to come.

Trainer Qualifications

People who design training courses often do not give a second thought to who will conduct the training. In many cases, there is no choice. However, research indicates that, whenever possible, the trainer should be a colleague (Glenn & Carrier, 1987). Sometimes, however, a colleague does not possess the necessary skills and competencies to conduct training. Several alternatives are available, (see "Finding Outside Trainers," below). All trainers

Finding Outside Trainers

When neither you nor your staff have the expertise to provide training, consider using outside presenters. We've been able to extensively use several manufacturers to provide training on assistive technology. They conduct half-day or all-day workshops. Although they focus on their products, it's actually a much broader application. Vendors talk about the philosophy and the general approaches to using technology. It's been a very good training approach for both in service and preservice programs

— Mike Behrmann
George Mason University

I don't usually have guest speakers in my courses, but for the technology modules, I often invite one. If you're starting out or even if you've been going awhile, consider experts in the state or local school districts. I have found them to be extremely generous. They are excited when I call and ask them to speak. That's because they're out there, pretty much alone. They're getting new teachers and new therapists who know nothing about technology. They are just so happy that one of the colleges in the state is finally doing something, that it is actually a pleasure for them to come and speak.

— Amy Dell
Trenton State College

trainers need to be competent at instructing adults and in the area of technology covered by the course or workshop. (Glenn & Carrier, 1987; Mistrett, Raimondi, & Barnett, 1990).

Perhaps one of the best resources for planning training is *Effective Inservice for Integrating Computer-as-Tool into the Curriculum* (Moursund, 1989). This book provides comprehensive information for inservice trainers and is well worth the investment. Another resource is *Preparing for and Conducting Workshops and Presentations* (Reed, 1990).

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OUTCOMES AND COMPETENCIES

Most of the models described in the previous sections identified competencies for their students and objectives for their training model. The process for developing competencies varies across institutions. Competencies are the knowledge, skills, and attitudes that people need to perform their role (Blackhurst, 1990). Training competencies may come from many sources, but are usually developed to expand and define the goal statements for training. Some institutions use formal research methods to develop competencies. Others use committees to brainstorm and develop competencies. This section discusses how some groups developed competencies and how they use them. We also give examples of various competencies.

Development of Competencies

The University of Kentucky has perhaps the most comprehensive set of competencies. Blackhurst (1990) identified 87 technology competencies for special education teachers. They are divided into 11 broad categories (see Appendix for a complete list).

- Acquire a body of knowledge about the use of microcomputers and related technology.
- Evaluate software and other related materials.
- Develop a plan for technology use.
- Use technology in assessment and planning.
- Use technology to facilitate instruction.
- Use technology to compensate for students' learning barriers.
- Use microcomputer to generate teaching aids.
- Use the microcomputer as an aid to personal productivity.
- Disseminate information about applications of technology.
- Assemble, operate, and maintain the components of technology.
- Use microcomputer operating system commands.

Before planners in Kentucky developed these competencies, they identified the roles and functions of program graduates. Roles included graduates who would become special education teachers, administrators, speech/language pathologists, occupational therapists, physical therapists, and technology specialists.

Competency validation is an evolutionary process, which proceeds in four phases: a task analysis phase; a social validation phase, which includes soliciting expert opinion, and documenting effective practices; a direct observation phase; and a learner-referenced evaluation phase. Most efforts to validate competencies, including those at the University of Kentucky, have focused on phases 1 and 2. Efforts are being initiated to implement validation studies in phases 3 and 4.

The state department of education in Michigan initiated a task force (later called COMPUTE) to identify and refine the competencies needed by teachers graduating from institutes of higher education in their state. The competencies in the use of technology were developed for special education administration, instructional staff, and ancillary services in five comprehensive areas:

- General technology literacy.
- Instructional software.
- Evaluation of hardware and software.
- Adaptive devices.
- Directed experience.

Each list of competencies is divided into three skill levels: awareness (knowledge), utilization (skill development), and proficiency (skill application) (see Appendix for complete listing).

The Northwest Council for Computer Education (NCCE) and Oregon State University also used a committee approach to generate competencies. This coalition funded a project to develop competencies for use as guidelines in reevaluating both inservice and preservice teacher education programs (Niess, 1990). Twenty specialists developed and evaluated competencies for nine categories of educators:

- Elementary school teachers.
- Middle school teachers.
- High school teachers.
- Elementary school computer teachers.
- Middle school computer teachers.
- High school computer teachers.
- District computer coordinator for the elementary level.
- District/building computer coordinator for the middle school level.
- District/building computer coordinator for the high school level.

Competencies were edited, clarified, and refined using a modified Delphi procedure, a system that utilizes written responses (Delbecq, Van de Ven, & Gustafson, 1973). This approach replicated a study conducted by the authors in 1983. Changes in competencies from 1983 to 1989 included the addition of keyboarding skills (the earlier the better) and the removal of programming skills. The most significant change was in the use of verb phrases. Verb phrases changed from "should have knowledge" (1983) to "should use" (1989). Niess (1990) concludes that no longer is simply having knowledge acceptable; teachers must use that knowledge in the classroom.

Uses of Competencies

Institutions and coalitions usually develop lists of competencies to use as criteria to certify that the individual has mastered a particular skill. Performance-based measures are often used to determine that criteria have been met. In addition, competencies can be used as a self-assessment instrument. Blackhurst (1990) developed a self-assessment instrument based on the University of Kentucky's competency list for teachers to evaluate their own knowledge and skills in technology use (see Appendix for a copy of this form). For each of the 87 competency statements, teachers are asked to circle the letter that corresponds to their interest in developing either knowledge or skills. It is a 5-point list ranging from "not interested" to "have some skill." This information can be used as a self-assessment for teachers, as an instrument for social validation, as a way to monitor student performance, and as a needs assessment of teachers in designing inservice training programs.

Mistrett, Raimondi, and Barnett (1990) have developed a 6-option self-evaluation form to measure technical skills. This checklist provides an overall picture of participants' ability. A 6-point scale ranging from "unfamiliar" to skills at the "automatic" level is used. Participants can use it as a pretest to evaluate their current level of skill prior to training, and they can use it as a posttest or as an ongoing evaluation of their work in their own classrooms and their growth as technology users.

COMPUTE (1989) has also developed a self-evaluation form for each of the six modules (see Appendix for an example of a module evaluation form). For each competency, participants are to indicate on a 4-point scale their relative familiarity with technology. Items rank from "don't know" to "experienced with."

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Appendix

TECHNOLOGY COMPETENCIES FOR SPECIAL EDUCATION TEACHERS

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In order to use technology effectively in special education programs, teachers should be able to ...

Acquire a body of knowledge about the use of microcomputers and related technology in special education.

1. Explain historical developments and trends in the application of microcomputers and related technology in special education.

2. Define terms and concepts related to technology applications in special education.

3. Identify major issues associated with the use of technology in special education.

4. Identify ways that microcomputers and related technology, such as interactive video, robotics, and adaptive devices, can be incorporated into the special education curriculum to meet the instructional goals and objectives of students.

5. Describe criteria for making decisions about the selection and purchase of microcomputers and related technology.

6. Read, evaluate, and apply information about technology applications in special education that appear in the professional literature and trade magazines.

7. Describe findings of research on technology use in special education.

8. Participate in activities of professional organizations that focus upon applications of technology in special education.

9. Maintain a professional development program to ensure the acquisition of knowledge and skills about new developments in technology as they become available.

Evaluate microcomputer software and related materials for their potential application in special education programs.

10. Identify the purpose of the instructional program, its objectives, and the validity of its content.

11. Determine the characteristics of learners for whom the program is appropriate.

12. Describe the format and ways information is presented to the learner.

13. Determine the extent of student control over the program.

14. Describe the commands required to use the materials, the academic and physical demands placed on the student, and the speed and accuracy of the program.

15. Identify the type and frequency of feedback and reinforcement provided by the program.

16. Determine the extent of branching within the program.

17. Identify the options that exist to enable the teacher to modify features of the program.

18. Determine the adequacy of program documentation.

Develop a plan for technology use in a special education program.

19. Articulate goals and a philosophy for using technology in special education.

20. Identify elements of the special education curriculum for which technology applications are appropriate and ways they can be implemented.

21. Determine the physical requirements for implementing various technology systems in a special education classroom.

22. Ensure that special education students have equitable access to technology in any plans that are developed.

23. Prepare guidelines and rules for technology use in the special education classroom.

24. Identify resources available to support the use of technology in special education.

25. Develop a budget for technology applications in a special education classroom.

26. Identify funding sources for technology hardware, software, and accessories.

27. Write proposals to obtain funds for technology hardware and software.

Use technology in special education assessment and planning

28. Identify programs that can be used for assessing exceptional children and planning their educational programs.

29. Use microcomputers to administer tests to exceptional children.

30. Use software programs that can score and interpret the results of standardized tests.

31. Use microcomputers to generate assessment reports.

32. Use microcomputers to record observational data in special education environments.

33. Use computer software programs to analyze, summarize, and report student performance data to aid instructional decision making.

34. Use a microcomputer program to generate an Individualized Education Program (IEP).

35. Explain the pros and cons of computerized programs that generate IEPs.

Use technology to facilitate instruction in special education programs.

36. Use technology to support effective instructional practices.

37. Arrange the physical environment to facilitate the use of technology.

38. Teach special education students to operate equipment and run microcomputer software.

39. Teach students how to use microcomputers to increase their personal productivity and independence.

40. Identify and use appropriate tutorial software programs.

41. Use drill and practice programs appropriately.

42. Incorporate simulation and problem solving programs into the curriculum.

43. Use microcomputers to teach students written composition and communications skills.

44. Teach students to use microcomputers for telecommunications and to access electronic databases.

45. Use computers and related software for reinforcement.

46. Use peripheral devices, such as printers, hand controllers, modems, and graphics tablets.

47. Evaluate the effectiveness of technology applications in the special education classroom.

48. Adhere to ethical standards when applying technology in special education.

Use technology to compensate for learning barriers that are due to communication disorders, physical disabilities, or visual impairments.

49. Determine the adaptive switches, software, and related equipment needed for students with communication disorders, physical disabilities, or visual impairments.

50. Connect and use alternate keyboards, other adaptive input and output devices, and construct materials for their use.

51. Construct adaptive switches to control access to computers.

52. Use technology to enable students to control other devices to their environment.

53. Use scanning devices and programs to facilitate single key and switch operation of computers.

54. Use of speech synthesizer and the software that controls it.

55. Use electronic communication boards and augmentative communication aids.

56. Use software and hardware that presents magnified text for partially sighted students.

Use the microcomputer to generate teaching aids for the special education classroom.

57. Use software programs to produce signs, transparency masters, and other visual aids.

58. Use software programs to produce worksheets for student use.

59. Design databases that students can use to store and retrieve information.

60. Use instructional shell programs and authoring systems to develop computer assisted instruction lessons.

61. Use test generation software programs to develop test banks and prepare examinations.

62. Use instructional data graphing and analysis programs.

63. Use gradebook software programs to store and report student grades.

Use a microcomputer as an aid to personal productivity.

64. Use a word processor to prepare lesson plans, class notes, correspondence, and other written documentation.

65. Use software utility programs, such as mail merging programs and spelling checkers.

66. Use database programs to maintain student records and resource files.

67. Perform statistical analyses with microcomputer software.

68. Perform statistical analyses with microcomputer software.

69. Use telecommunication systems and electronic messages services (e.g., SpecialNet).

70. Access information from electronic data bases to support professional activities (e.g., ERIC).

Disseminate information about applications of technology in special education.

71. Maintain a resource file of information about technology in special education.

72. Provide consultation and technical assistance to colleagues and to handicapped individuals about the use of technology.

73. Serve as a resource to parents of exceptional children who have microcomputers and related equipment available for use at home.

74. Make presentations about technology use in special education to lay and professional groups.

75. Conduct in-service training on technology applications in special education.

76. Prepare articles and reports about technology use in special education.

Assemble, operate, and maintain the components of technology systems in special education environment.

77. Connect audio and video equipment and input and output devises such as disk drives, printers, monitors, speech synthesizers, graphics tablets, video systems, and modems.

78. Configure software to ensure that all of its features will work properly with the equipment being used.

79. Explain operations that could cause hardware damage if not performed in an appropriate manner.

80. State the environmental conditions under which various technologies operate most efficiently.

81. Demonstrate the proper care of microcomputer disks and describe the effects that dust, magnetic fields, temperature, liquids, and physical abuse can have on them.

82. Use simple diagnostics to determine problems that may exist when a piece of equipment or a software program fail to operate properly.

83. Perform routine maintenance of a technology system.

Use microcomputer operating system commands.

84. Initialize diskettes in preparation for using them to store information for various applications.

85. Make back-up copies of commercial software and copies of public domain software using programs that will copy entire disks and programs that will copy one file at a time.

86. Use the operating system and utility software programs that accompanying the computer being used.

87. Type and run computer programs that are printed in computer magazines.

TECHNOLOGY COMPETENCIES FOR SPECIAL EDUCATION TEACHERS[1]

SELF-ASSESSMENT

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DIRECTIONS: For each of the competency statemens, circle the letter that corresponds to your interest in developing either knowledge or skills Use the following key:

N = Not interested in developing knowledge or skills in this area
C = Already competent in this area
A = Limited knowledge in this area; interested in developing an awareness
S = Have an awareness; need to develop skills in this area
E = Have some skills; need to refine or expand them

NAME: _____ DATE: _____

In order to use technology effectively in special education programs, teachers should be able to...

Acquire a body of knowledge about the use of microcomputers and related technology in special education.

1. Explain historical developments and trends in the application of microcomputers and related technology in special education. N C A S E
2. Define terms and concepts related to technology applications in special education. N C A S E
3. Identify major issues associated with the use of technology in special education. N C A S E
4. Identify ways that microcomputers and related technology, such as interactive video, robotics, and adaptive devices,can be incorporated into the special education curriculum to meet the instructional goals and objectives of students. N C A S E
5. Describe criteria for making decisions about the selection and purchase of microcomputers and related technology. N C A S E
6. Read, evaluate, and apply information about technology applications in special education that appear in the professional literature and trade magazines. N C A S E
7. Describe findings of research on technology use in special education. N C A S E
8. Participate in activities of professional organizations that focus upon applications of technology in special education. N C A S E
9. Maintain a professional development program to ensure the acquisition of knowledge and skills about new developments in technology as they become available. N C A S E

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[1] Permission is granted to duplicate this competency self-assessment for non-commercial use.

Special Education Instructional Competencies in the Use of Technology

The following competencies are included in the Michigan Special Education Technology Plan. They have been used as the basis for the development of the training modules developed by COMPUTE, and are referenced in each of the modules by number.

AWARENESS LEVEL (Awareness)

At this level information about technology is introduced. Individuals know little about technology, especially as an educational tool, and may need to acquire a positive attitude about the use of technology in special education as well as education in general. At this level the special educator will be able to:

1. Recognize the component parts, functions, and appropriate care of a microcomputer.
2. Use and Understand terms necessary to use microcomputers and technology effectively.
3. Recognize the need for preparing the handicapped to live and work in the information age, including the use of technology to compensate, remediate, communicate and control environments.
4. Recognize the need to integrate technology into the instructional curriculum for the handicapped.
5. Identify the general uses for technology in education to store and manipulate data with emphasis on the needs of the handicapped.
6. Identify the present uses for technology in the world of work and for effective living for the handicapped.
7. Recognize the importance of being familiar with the documentation for hardware, software and adaptive devices.
8. Understand the importance of evaluating technology prior to purchase.
9. Develop an understanding of the input-output information processing model, including the impact that sensory deficits have on the learner and how technology can be used to compensate for these deficits.
10. Understand the importance of planning and cost effectiveness in integrating technology into educational systems and into the curriculum.
11. Understand the use of telecommunications and networks.

KNOWLEDGE LEVEL (Knowledge)

The goal of this level is to provide a personal orientation to the special educator so that the professional can approach the computer with relative comfort and have a broad understanding of its capacity. The special educator will have knowledge of:

12. The resources available for information about and assistance with the uses of technology with the handicapped.
13. Ways of integrating computers and other technology into the curriculum.
14. Implications that FERPA, copyright laws and licensing have on the implementation of applications within the school setting.

15. Appropriate uses of the following:

    a. types of computer assisted instruction - CAI
    b. types of computer managed instruction - CMI (such as IEP and teacher management systems
    c. applications software (such as word processing, spread sheet, data base management)
    d. emerging technologies (such as computer assisted videodisk instruction - CAVI)
    e. telecommunications and networks
    f. adaptive devices
    g. shell programs adaptable to individualized content material
    h. authoring systems

16. Use of technology as a tool for the following purposes:

    a. To compensate in
        control of the environment
        communication
        mobility

    b. To improve skills for
        learning
        leisure time activities
        vocational activities
        basic living skills

17. Components that comprise an appropriate evaluation of hardware, software and adaptive devices for instructional uses.

18. Components that comprise an appropriate evaluation of software for:

    a. instructional information (documentation, modification of content, etc.)
    b. educational adequacy
    c. technical adequacy
    d. compatibi[illegible] with hardware and adaptive devices
    e. appropriateness in meeting the needs of the handicapped.

19. Components that comprise an appropriate evaluation of adaptive devices.

20. Questions that need to be addressed prior to the purchase of adaptive devices taking into account the characteristics of the user and the device.

21. Characteristics of adaptive device categories, including:

    a. alternative switches
    b. touch-sensitive input devices
    c. speech and other non-touch input
    d. speech output
    e. modified displays
    f. tactile output
    g. special needs software

22. The need for developing a team approach and the resources available for information about and assistance with the uses and evaluation of adaptive devices.

23. Organization and management of technology for effective educational use in the classroom and/or lab situation.

24. Resources available for information about and assistance with the uses of technology with the handicapped through user groups, and other human resources, banks, data bases, etc.

UTILIZATION LEVEL (Skill Development)

The goal of this level is to provide the skills needed by the special educator to implement computer applications for management and establish an understanding of computer's instructional value. The special educator will:

25. Communicate effectively with others using appropriate technological/computer terminology.

26. Identify and remedy common problems with hardware, software and adaptive devices.

27. Use hardware and appropriate software for basic computer operations, including "booting" a program, formatting a disk, backing up (copying) a disk and copying selected files to another disk.

28. Access and use software for:

    a. computer assisted instruction - CAI:
        1. drill & practice
        2. tutorial
        3. simulation
        4. problem solving
        5. utilities
    b. shell programs adaptable to individualized content material
    c. computer managed instruction - CMI
    d. word processing and data base management
    e. telecommunications and networks
    f. adaptive devices

29. Write lesson plans which integrate technology into teaching specific skills to handicapped students.

30. Evaluate the appropriateness of hardware, software and adaptive devices for meeting the needs of handicapped learners.

31. Evaluate software for instructional information, educational adequacy, technical adequacy and adaptive devices, etc.

32. Develop evaluation plans for hardware, software, adaptive devices, etc. that are applicable to specific populations and specific situations and/or educational systems.

33. Have a directed experience utilizing adaptive devices that compensate for specific student deficits.

Self-Evaluation: Microcomputers in Special Education

For each of the items below, indicate your relative familiarity by placing a check mark (√) in the appropriate column.

COMPUTE Competency:	Don't Know	Brief Understanding	Feel Comfortable	Experienced With
1. Recognize the component parts, functions and appropriate handling of a microcomputer.				
2. Define terms necessary to use microcomputers effectively.				
3. Recognize the need for preparing the handicapped to live and work in the Information Age.				
4. Describe different types of computer software.				
5. Discuss issues such as integrating technology into the curriculum, privacy, copyright and licensing.				
6. Recognize the importance of being familiar with documentation for hardware, software and adaptive devices.				
7. Initialize and copy a diskette.				
8. Know beginning strategies for troubleshooting.				
9. Know resources for getting additional help with computers.				
10. Know how microcomputers can best be used in special education.				

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COMPETENCIES IN SPECIAL EDUCATION TECHNOLOGY

1.0 Make a computer ACCESSIBLE to individuals who have physical and/or sensory impairments.

1.1 Identify simple assistive devices such as a keyguard and headpointer.

1.2 Describe adaptive inputs, such as the Power Pad, Muppet Keys, Touch Window, Unicorn Expanded Keyboard, joystick and voice input; and adaptive outputs, such as a speech synthesizer, large fonts, and a braille printer, and explain who might benefit from their use.

1.3 Use simple adaptive inputs and outputs.

1.3.1 Use a Power Pad, Muppet Keys, Touch Window, Unicorn Board, or similar alternative input device.

1.3.2 Use an adaptive switch (with options from the Adaptive Firmware Card) to write a short paragraph. (See 5.0 below.)

1.3.3 Use a speech synthesizer.

1.3.4 Use a large print display.

1.4 Evaluate and use appropriate software for each of the adaptive inputs and outputs (see 2.1 below).

1.5 Participate in a multidisciplinary evaluation of a person for the selection and placement of appropriate assistive devices, adaptive inputs and/or outputs.

2.0 Use computer-assisted instruction (CAI) with handicapped individuals.

2.1 Evaluate and select appropriate software.

2.1.1 Determine the characteristics of learners for whom the software is appropriate.

2.1.2 Identify the purpose of the software, its objectives, and validity of its content.

2.1.3 Describe the software format and the ways in which information is presented to the learner.

2.1.4 Determine the extent of student control over the

program.

2.1.5 Describe the computer-use commands. academic demands, and physical demands which the program places on the student.

2.1.6 Identify the type and frequency of feedback and reinforcement.

2.1.7 Determine the extent of branching within the program.

2.1.8 Identify options that enable the teacher to modify features of the program.

2.1.9 Identify options for record keeping.

2.1.10 Determine the adequacy of program documentation.

2.2 Use various types of CAI software

2.2.1 Use drill and practice programs

2.2.2 Use tutorial software.

2.2.3 Use simulation software.

2.2.4 Use problem-solving software.

2.3 Customize software.

2.3.1 Modify features of a CAI program for a particular student's needs.

2.3.2 Use a mini-authoring (shell) program to create a customized program.

2.3.3 Create customized overlays for expanded keyboard.

2.4 Integrate CAI into the curriculum.

2.4.1 Match the content of selected software to the content and process of the curriculum.

2.4.2 Determine student's existing computer skills.

2.4.3 Develop a plan for computer use by a particular student.

2.4.4 Utilize the record keeping features of selected CAI software and base lesson plans on the information.

3.0 Use applications software appropriately with handicapped individuals.

3.1 Demonstrate the use of word-processing as a writing tool.

3.1.1 Select appropriate software program (see 2.1 above).

3.1.2 Identify requisite keyboarding (or adaptive input) skills.

3.1.3 Integrate the use of word-processing into subject areas.

3.2 Use word-processing, story-writing, and desk-top publishing programs as aids in the teaching of writing and reading.

3.3 Integrate telecommunications activities into the curriculum.

3.3.1 Demonstrate an awareness of telecommunications networks.

3.3.2 Use a telecommunications network in the teaching of writing.

3.4 Integrate database and spreadsheet programs into the secondary curriculum appropriately.

4.0 Enhance the COMMUNICATION ABILITIES of handicapped individuals who would benefit from the use of electronic augmentative/alternative communication (AAC) systems.

4.1 Discuss the factors which must be considered when choosing an AAC system for a handicapped individual, such as means of indication, vocabulary selection, symbol selection and placement, motor demands, cognitive demands, portability, speed, flexibility, cost, etc.

4.2 Describe how several AAC systems are used and the physical and mental demands each places on the user.

4.3 Demonstrate how to use a computer system as an alternative communication device.

4.3.1 Use an adaptive switch with an option on the Adaptive Firmware Card.

4.3.2 Use the Power Pad, Muppet Keys, Unicorn Board, or similar device with appropriate communication program.

4.4 Carry on a simple conversation using a dedicated device such as the Wolf, Alltalk, Lightalker, or similar device.

4.5 Collaborate with appropriate support staff in selecting and designing an AAC system for a handicapped individual.

5.0 Use ADAPTIVE SWITCHES appropriately with handicapped individuals.

5.1 Demonstrate how to activate an adapted toy/device using a variety of adaptive switches.

5.2 Describe the major uses of adaptive switches; providing access to computers, leisure activities, and mobility systems, as environmental controls, and being used for instructional purposes.

5.3 Describe the physical demands placed on the user by a variety of adaptive switches, and discuss who would be likely to benefit from the use of each type.

5.4 Construct an adaptive switch for use by a handicapped person.

5.4.1 Carry out appropriate decision-making: Choose an appropriate switch for a particular person, decide what it will be used for, and investigate placement possibilities.

5.4.2 Perform the necessary electrical work.

5.4.3 Create an appropriate and sturdy housing for the switch.

5.4.4 Adapt a battery-powered toy/device using a battery interrupter or jack, and use with switch.

5.5 Make simple repairs to switches.

6.0 PLAN for the INTEGRATION OF COMPUTER USE by handicapped individuals in a special education setting.

6.1 Prepare a convincing statement to be presented to a building principal or school board on the potential benefits of computer use by handicapped students.

6.1.1 Conduct a bibliographic search on CD-ROM.

6.1.2 Describe ways that microcomputers and related technology can be incorporated into the special education curriculum to meet the instructional goal and objectives of students.

6.1.3 Support your arguments with findings from the research literature on microcomputer use in special education.

6.1.4 Demonstrate awareness of legal and ethical issues (such as restrictions on copying software) and the need to

provide equal access to technology to persons of all racial and ethnic groups, socioeconomic levels, gender, and handicapping conditions.

6.2 Identify resources which support the use of computers in the classroom.

6.2.1 Demonstrate an awareness of technology resource centers in your state/area.

6.2.2 Demonstrate an awareness of national organizations such as Closing the Gap, TAM/CEC, ISAAC, RESNA, and the Special Education Technology Center/CEC.

6.2.3 Identify software evaluation services, and use.

6.2.4 Identify relevant telecommunications networks such as SpecialNET, Applelink, CompuServe, and the Educational Technology Network.

6.2.5 Identify possible funding sources.

6.2.6 Network with other technology users in the region (teachers, rehabilitation personnel, etc.).

6.3 Determine priorities for hardware and software acquisition.

6.4 Plan the classroom set-up: Computer work space, storage, student scheduling.

6.5 Assemble and maintain the classroom's hardware and software.

6.6 Use basic computer commands for disk preparations.

6.6.1 Format disks for future use.

6.6.2 Make back-up copies of software programs.

6.7 Troubleshoot minor technical problems and/or be aware of available resource people.

7.0 Use a computer to facilitate the completion of RELATED PROFESSIONAL RESPONSIBILITIES.

7.1 Use word-processing and selected utilities as aids to personal productivity.

7.2 Use a telecommunications network to access and/or share information on teaching handicapped individuals.

7.3 Use a computer to produce teaching materials such as puzzles, overheads, and worksheets.

7.4 Use a computer-assisted scoring program in assessment.

7.5 Participate in the development of an IEP through the use of an appropriate software package.

7.6 Use a data collection program to facilitate behavior management.

2 of 2

Trainer's Resource Guide

Training Materials Design Guidelines

Center for Special Education Technology

A Project of
The Council for Exceptional Children

Funded by
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U. S. Department of Education

September 1991

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Center for
Special Education
Technology

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Contents

PREFACE

Technology training has been a theme for several information products and activities of CEC's Center for Special Education Technology, a federally funded information center.

This document, *Trainer's Resource Guide: Training Materials Design Guidelines*, and its companion guide, *Trainer's Resource Guide: Program Planning Ideas*, were developed at the request of trainers wishing to have references and models to aid their training efforts. *Training Materials Design Guidelines* contains guidelines for preservice and inservice trainers interested in designing their own training materials. It is not intended to be all encompassing; rather, it concentrates on the design of five types of training materials and includes references for more complete discussions of each of these five types. Each of the chapters has been designed as a stand alone piece to fit individual trainer needs.

A unique feature of this guide is the presence of "Viewpoint" sections placed at the end of each chapter. These viewpoints are based on informal conversations with experienced trainers who offer their advice, thoughts, ideas, and successes. We hope that by sharing advice and lessons learned by other trainers, the task of training will be made easier for you.

We thank the trainers who contributed their ideas to this guide: Mary Anderson, Center for Special Education Technology; Gail Fitzgerald, West Virginia University; Colleen Haney, Pennsylvania Assistive Device Center; Ted Hasselbring, Peabody College, Vanderbilt University; and Judith Sweeney, University of Connecticut.

The Center would also like to thank the review panel members, who gave valuable suggestions throughout the development of both *Trainer's Resource Guides*: Joan Basile, Georgia Learning Resources System; Michael Behrmann, George Mason University; Janis Bing, Texas Education Service Center, Region 6; Kathy Hurley, IBM; Jeffrey Messerer, Northeastern Illinois University; Lewis Polsgrove, Indiana University; Barbara Reeves, Ohio University; and Pamela Ross, INNOTEK. Additional reviews for this guide were provided by Jerry Chaffin, University of Kansas, and Gail Fitzgerald, West Virginia University.

THE DESIGN PROCESS

This section gives you an overview of how to go about designing training materials.

Importance of Training Materials

Technology trainers use training materials to illustrate concepts, emphasize points, and clarify details. For example, a preservice trainer might use a videotape segment to illustrate how a classroom teacher incorporates the computer in a lesson on geography. Or an inservice trainer might hand out a computer startup sheet as a reference for the classroom teacher participants to use in their own classes. Or a technology trainer might use an interactive video simulation to clarify the assessment skills of his or her students when determining an appropriate augmentative communication device. Good training materials can help trainers get instructional messages across to their students.

Tell me and I'll forget; show me and I'll remember; involve me and I'll understand.

—Zen Proverb

Use Existing Materials

Trainers can either use existing materials or create their own. The decision to develop instructional materials is a significant one because developing good training materials, especially some of the more sophisticated high-tech media, takes time.

Use the *Directory of Technology Training Materials*, developed by the Center for Special Education Technology, to locate appropriate training materials.

Create New Materials

If you decide to create your own training materials, it's a good idea to follow guidelines that other developers have derived to produce effective materials. This document provides basic guidelines and refers you to other sources for more in-depth coverage (see the heading "For More Information" in each chapter).

Before rushing to write or produce a product, take time to think through the project. Planning is the key to designing and producing good instructional materials. Begin with identifying what the purpose of the intended training material is, what the needs and existing skills of the learner are, how the content will be presented, and how the training material will be used and evaluated.

Many instructional design models provide frameworks for developing materials. They identify the important elements in planning and producing the materials. The models also tend to be comprehensive: as you work through a model, you complete the various development tasks in an efficient order. Many activities build on earlier tasks.

A well-known, formal instructional development model is offered by Dick and Carey (1990) (see "Dick/Carey Systems Approach," below). It is an all-encompassing model designed for entire courses. Other models have been designed for specific types of instructional materials, such as Alessi and Trollip's (1985) model for computer assisted instruction (CAI) (see "Alessi and Trollip's 8-Step Model," below). As a developer, you will probably want to adapt an existing model to fit your

Dick/Carey Systems Approach Instructional Design Model

1. Identify an instructional goal.
2. Conduct an instructional analysis.
3. Identify entry behaviors and characteristics.
4. Write performance objectives.
5. Develop criterion-referenced test items.
6. Develop an instructional strategy.
7. Develop and/or select instruction.
8. Design and conduct the formative evaluation.
9. Revise instruction.
10. Conduct summative evaluation.

Source: Dick, W., & Carey, L. (1990). *The systematic design of instruction* (3rd ed.). Glenview, IL: Scott Foresman.

needs (see Gail Fitzgerald's comments in "Infusing Instructional Design Skills," at the end of this chapter).

Development Steps

Generally, design models have four components:

* *Plan.* Determine the material's purpose and specific training objective, consider the prerequisite skills and needs of the adult learner, define the content and approach of the presentation, and select the medium.
* *Draft-Write-Revise.* Take the constraints and factors identified in the plan stage and create an exciting draft of the material, sketch visuals, incorporating elements of effective instruction, try out the material, and rearrange or revise the draft based on the tryout.
* *Produce.* Render the artwork, format and prepare printing masters, tape the video, and program the computer. Often production is conducted in two phases: A small part of the materials (such as a section of a computer lesson) is prepared and tried out; and then, based on the results, the rest of the production is completed.
* *Evaluate and Revise.* Try out the final product on potential students and revise it as needed (see the section "Testing and Revising" later in this chapter).

Selecting a Medium

One early step in most instructional development models is determining the appropriate medium, or format, of your instructional material, such as print, video, or projected media.

* *Educational objectives.* Select a format based on your educational objectives. Choose a medium that best supports your objective, according to the medium's inherent qualities. For example, if you want to demonstrate how a child with disabilities can interact with classmates through an augmentative communication device, then you might decide to use a videotape with examples of classroom socializing—

because videotape can capture motion well.

* *Practical considerations.* Often, more practical considerations may influence your choice of format. These factors include affordability, ease of use and availability of equipment, and reliability. As a technology trainer, be aware of an additional bias—that of favoring high-tech solutions. More complex technology does not necessarily ensure better instruction. Lower tech formats may actually be more appropriate. For example, to communicate key ideas, a simple overhead transparency may be more available and reliable than a projected computer screen.
* *Cost effectiveness.* If you teach a course only once to a few people or if the content of the training will be outdated quickly, you may not find it cost effective to develop elaborate high-tech materials for the training.

Testing and Revising

You will discover that designing instructional materials is an iterative process—as you try the materials out, they will go through many draft and revision stages.

To increase the potential effectiveness of the instructional material, you must build testing and revision into the process. Too often, when materials are developed, the developers feel such relief when they are "finished" that they make no attempt to determine if the materials actually work as planned.

Test the materials with colleagues and students and revise them based on feedback throughout the development process. This feedback is often called *alpha testing* or *formative evaluation*. For widely used and disseminated materials, be sure to conduct more extensive field testing (often called *beta testing*, or *summative evaluation*).

Dissemination

Creating your own instructional materials allows you to present information to fit your particular class requirements and needs of your students. Designing just for your class often simplifies production. Keep in mind, however, that the materials you create may be useful to other trainers, so in your initial planning, you may

Alessi and Trollip's 8-Step Model for Developing Computer-Based Instruction

1. Define your purpose.
2. Collect resource materials.
3. Generate ideas for the lesson.
4. Organize your ideas for the lesson.
5. Produce lesson displays on paper.
6 Flowchart the lesson.
7. Program the lesson.
8. Evaluate the quality and effectiveness of the lesson.

Source: Alessi, S. M., & Trollip, S. R. (1985). *Computer-based instruction: Methods and development.* Englewood Cliffs, NJ: Prentice-Hall.

want to consider the material's exportability. Increasingly important is the requirements of federaaly funded grant recipients to disseminate resulting materials to as wide an audience as possible.

Dissemination considerations influence design decisions. If you decide to disseminate your materials to others, design for the lowest common denominator of your chosen hardware system. For example, if you are designing a CAI program on the Macintosh, use the Mac SE and its standards, even though the larger screen of the Mac II is available.

If you disseminate your product, provide ample documentation. Give suggestions for how to use the material. Describe where the materials fit into the curriculum. Provide supplementary activities and handouts.

For More Information

Alessi, S., & Trollip, S. (1991). *Computer-based instruction: Methods and development* (3rd Ed.). Englewood Cliffs, NJ: Prentice Hall.

An updated edition of the classic. This reference describes a CAI design model step by step with many examples for each step. *Available from:* Prentice-Hall, Inc., P.O. Box 500, Englewood Cliffs, NJ 07632; Tel: 201/592-2000.

Allred, K. F., & Locatis, C. (1988). Research, instructional design, and new technology. *Journal of Instructional Development 11*(1), 2-5.

Describes three instructional designs involving new interactive media: scenario-based, hypermedia, and parallel system designs. Looks at research on each of these designs in terms of intrinsic motivation, aptitude for learning, and learner control of instruction.

Briggs, L. J. (Ed.). (1991). *Instructional design: Principles and applications* (2nd ed.). Englewood Cliffs, NJ: Educational Technology Publications.

Contains the basic theoretical and procedural design model. Addresses needs assessment, goal analysis, and development of appropriate instructional and evaluation strategies. Includes how the design can be modified or adapted for individual educational institutions. *Available from:* Educational Technology Publications, 720 Palisade Avenue, Englewood Cliffs, NJ 07632; Tel: 201/871-4007.

Dick, W., & Carey, L. (1990). *The systematic design of instruction* (3rd ed.). Glenview, IL: Scott Foresman.

Describes a comprehensive design model. Discusses learning outcomes, learning analysis, objectives, subordinate skills, and lesson strategies. *Available from:* Scott, Foresman & Company, 1900 E. Lake Avenue, Glenview, IL 60025; Tel: 312/729-3000.

A Viewpoint on

THE DESIGN PROCESS:

Infusing Instructional Design Skills into Authoring Courses

by Gail Fitzgerald
West Virginia University

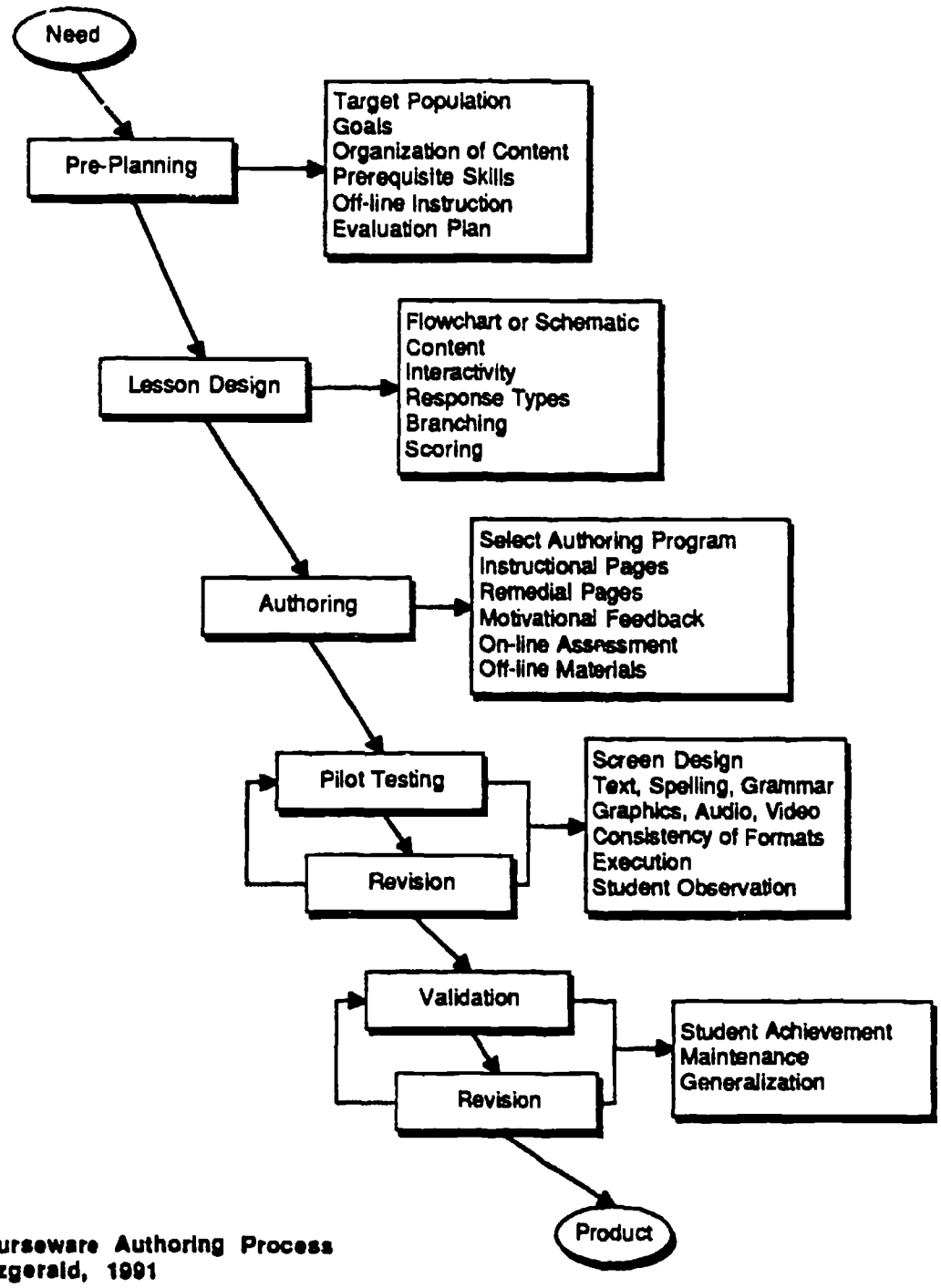
I have been using the infusion approach to teach instructional design principles as a part of computer applications courses at West Virginia University. The courses include projects for students at several levels of technological competence and experience. At the *first level*, students learn how to evaluate software. In lab activities and assignments, students apply principles of instructional design to evaluate the major types of software programs: drill-and-practice, tutorial, simulation, problem solving, and student tools. At the *second level*, students use more technical information in designing computer-based learning materials with mini-authoring, shell programs. After creating simple lessons, students critique their lessons according to principles of effective instructional design of CAI materials. At the *third level*, advanced students become involved in hypermedia or "open screen" authoring. To create their CAI materials from "scratch," they follow a systematic process approach based on an instructional design and development (IDD) model.

At this *third level*, I use an overall instructional design and development (IDD) model as a course organizer and take students step-by-step through the process. The students in these sessions are typically teachers who use CAI materials extensively in their classrooms; or they may be graduate students who want to learn more powerful authoring programs. Most have no formal training in instructional design of computer-based materials. They may have developed some knowledge through using software and have an understanding of how software types differ and important features of each. Although they have some insight in this area, they have not had formal instruction. Therefore, when they begin authoring, they basically operate on intuition. At this point, formalized instruction on CAI design gives them structure and information.

There are many different IDD models in the literature. For the novice designer, they all seem theoretical and esoteric. I try to make the IDD model concrete and realistic by providing examples of teachers' work in authoring. The IDD model I use is a hybrid model that I have adapted from different sources. It includes special features to make it fit the *Tutor-Tech* authoring program used at the master's level. The model is quite generic; it can easily be adapted for similar hypermedia authoring programs: *HyperStudio* or *HyperScreen* for the Apple II, *HyperCard* for the Macintosh, and *Linkway* for the IBM (see Figure 1).

I use this model in class to structure my teaching, provide the course organization, and set requirements for projects. *Steps 1 and 2* guide teachers through determining the need for lesson development and preplanning. The decisions made at the preplanning stage focus on the "what" of instruction—the need for developing a CAI lesson, who the target population is, what the lesson goals are, what content to present, and how the content will be organized, sequenced, and divided into smaller parts. Also, at this preplanning stage, I identify prerequisite skills for the target learners and evaluation procedures for the materials.

Figure 1



Courseware Authoring Process
Fitzgerald, 1991

Step 3 is the lesson design stage. Activities at this stage guide students through defining the mechanics of the lesson; for example, how the lesson will operate. Students organize the lesson content, flowchart its sequence, and plan instructional interactions for the learner. Students plan type of responses, branching, and recordkeeping—and they must complete all these instructional decisions before they sit down at the computer and begin to author the lesson.

I have found that when students skip some of these planning and design steps and just sit down and "wing it" as they go, they are in total chaos within a very short time. They get lost within the structure of the lesson because each screen they design with multiple options leads to multiple pages and they lose track of where each page links. When they don't have a plan, they don't know where they are or where to go. It's much more difficult to unscramble a lesson to make it

work correctly after it's created than it is to flowchart the lesson and create it from up-front planning. I spend several sessions working on these pre-planning and flowcharting skills before the students do actual authoring.

Step 4, the authoring stage, involves teaching the mechanics of the selected authoring system. With the *Tutor-Tech* authoring program, instruction focuses on how to create the various pages and how to link them. Skills include editing, adding graphics, changing fonts, managing lesson files, and setting up recordkeeping. The Courseware Authoring Process model (Fitzgerald, 1991) refers to the three basic page types created with *Tutor-Tech*: instructional pages, remedial pages, and motivational feedback screens.

After the lessons are authored, we return to *Step 5* of the model to guide pilot testing, or formative evaluation, of the lesson. The basic task here is to determine whether the lesson works as the student intended it to work. This involves having outsiders run the lesson, check all links, evaluate screen design, and review consistency and accuracy. Within the class, other students serve as peer reviewers to examine each other's lessons and give suggestions. Also, learners should be observed using the lessons to check for difficulties.

Step 6 leads the student through validating the materials using a group of "target" students to evaluate learner outcomes. Final revisions and packaging of the lessons are generally done after the graduate course is finished.

As an extension of the CAI authoring courses, I've started a user's group for teachers involved in authoring their own CAI materials. This group provides a network for teachers to share their lessons and a forum to review each other's materials. In my work in Iowa, the user's group primarily used a newsletter to link developers together. In West Virginia, we are starting a group made up of graduate students and teachers in the field using *Tutor-Tech*. Within this forum, more advanced information on CAI design will be provided and multimedia applications will be showcased.

My basic recommendations for teacher trainers who incorporate instructional design of CAI materials into courses are to: (a) select a planning model, (b) use that model as the course organizer, and (c) lead students through the steps of that process as they author and evaluate their CAI materials. The instructor must model the steps of instructional design and development throughout the course and sequentially teach the component skills. Ongoing support will help teachers extend their authoring skills to more advanced applications and to share teacher-created materials with others.

GOOD DESIGN FOR PRINT MATERIALS

This section gives you some design suggestions for developing print products.

Handouts and supplementary print materials are mainstays for technology trainers. For example, trainers design software startup cards as handy references for workshop participants. Trainers write supplemental readings to update textbook chapters. Print materials are easy to use and familiar to trainers and students. Well-designed handouts and supplementary print references catch the student's attention and aid the learning process, making the training experience more successful (see example below).

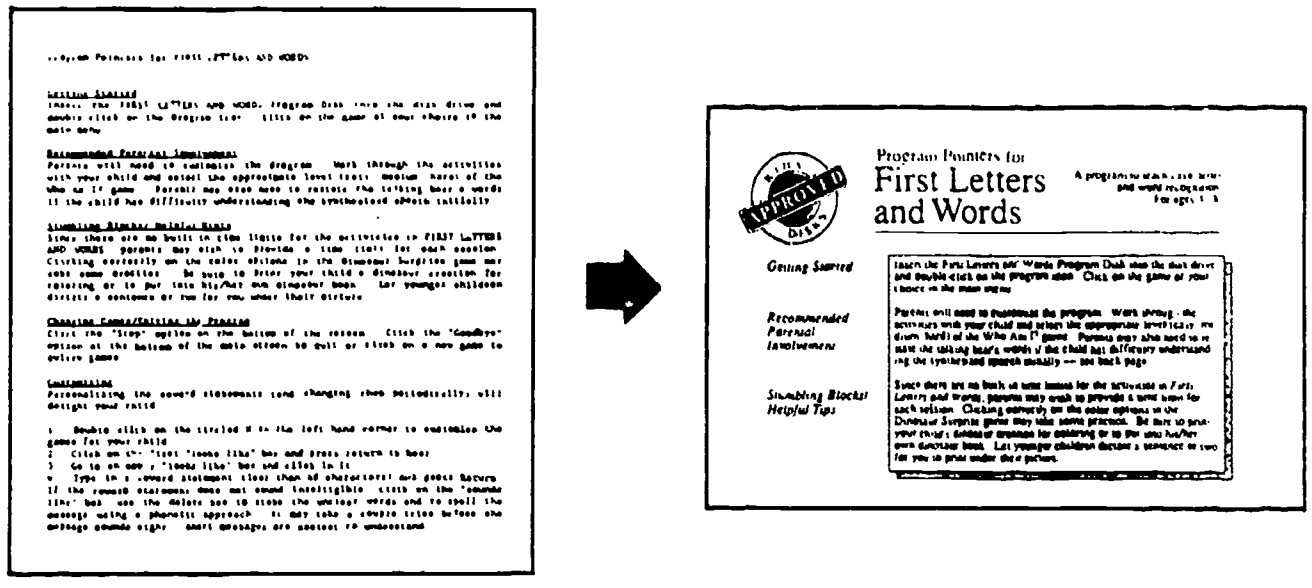
The design of print products has received more attention over the past few years with the introduction of desktop publishing. Trainers are not only writing but also formatting and typesetting their own high-quality products, using their office computers.

Development Steps

Even though print products are so familiar, they should still be considered "training materials" and be developed systematically, following an instructional development model.

Typical development might include the following four steps:

* *Plan.* Determine the purpose of the document, analyze students' needs, and identify how best to convey information.



Transforming straight text into a well designed handout aids learning.

- *Draft and Write.* Write a draft of the manuscript, try out the draft with a colleague or potential trainee, and revise and edit the document based on the try-out information. Any illustrations need to be sketched.
- *Production.* Lay out the page and prepare the document using desktop publishing. Charts and graphs need to be rendered.
- *Evaluate and Revise.* Try out the formatted document and revise it as needed.

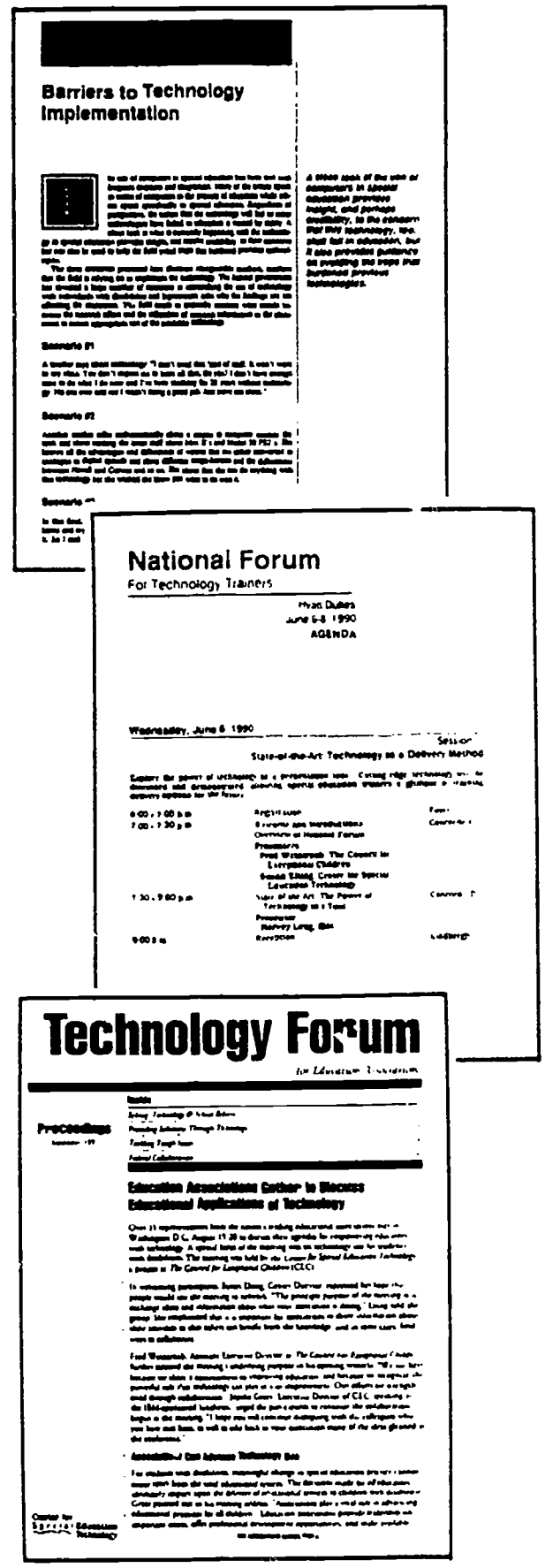
Writing the Document

Content included in print materials should be based on an analysis of the learning tasks and the needs of the student; that is, you should include only the facts and examples that will help the student learn. Extraneous information should be put in appendixes or omitted entirely. Short reference lists can refer learners to more extensive, in-depth information.

Clear, concise writing increases text readability and comprehension. Use the active voice and active verbs when creating sentences. Shorten sentences for easier comprehension. Divide long paragraphs into shorter ones to improve readability.

After the document is written, it needs to be edited and revised. Documents should follow an established style. "Style" used here refers to nongrammatical structure elements, such as word capitalization and hyphenation, punctuation, and reference citation. The American Psychological Association has a well regarded style manual used widely in education (and in this guide). *The Chicago Manual of Style* and the *U. S. Government Printing Office Style Manual* are also frequently used. Often an institution will create its own "house" style. Whatever style you choose, follow it consistently throughout the document.

Page Designs



Page designs need generous amounts of white space.

It is also a good idea to allow a professional editor to polish the text. *Substantive* editing deals with the clarity of the information as a whole, the tone of the document, and the organization of the paragraphs and sentences. *Technical* editing concentrates on correct grammar and consistent use of style elements. Once changes have been made, the revised manuscript needs to be proofread against the edited version to make sure changes were made and no additional errors introduced.

Tables and Charts

Tables, bar charts, and line charts break up the page, add visual interest, and increase comprehension. Print documents can accommodate detailed tables for reference, because the page can be studied at length, put down, and returned to as necessary. Yet, charts and graphs may be better to use than complex tables because they can show relationships at a glance. Simplified tables may be better than complex tables to communicate the information. Before including a comprehensive table of data in a document, determine what your purpose is for incorporating the data and consider the design alternatives.

Production

You can produce print materials with computer word processing programs and then format them either through the same word processing program or another more graphics-oriented desktop publishing software. Word processing programs offer several formatting options: large type, bold letters, indents, and columns. Desktop publishing programs provide even greater options: variety in fonts (type styles), text and column manipulation capabilities, and insertion of artwork.

Generally, good page layouts are simple; material is presented so that the student can read it quickly and understand it easily. Good page layout helps the eye move across the printed page. The spacing of lines and paragraphs, and the amount of white space in margins and between sections and headings all play a part in defining and clarifying the structure of the text (see "Page Designs," above, and "Headline and Text Type Styles," below). There is a sense of balance and proportion between the text and other design elements.

However, with the advent of desktop publishing, some print products have been overloaded with "design" features and are tacky, hard-to-read publications. Restraint is needed; as is design assistance. Trainers can hire graphic artists to

Headline and Text Type Styles

Serifs are short lines or embellishments to a letter at the upper or lower ends of the letter. Serif type faces have these extra lines, san serif types faces do not.

This is serif type.

This is san serif type.

San Serif Headline/Serif Text

San serif type is good for headlines against serif type because it provides contrast to serif text copy. Serif text is easy to read in large blocks of type because the form of the letters aids in their identification.

Design Considerations

Follow these seven principles when designing your document.

1. *Proportion*—The size of each design element should be based on its importance.
2. *Direction*—The design should guide the reader through the publication.
3. *Consistency*—Use an integral style throughout the document.
4. *Contrast*—Provide dynamic interest.
5. *Total Picture*—Consider the entire document as the design.
6. *Restraint*—Simplicity is vital to design.
7. *Attention to Detail*—Proofreading and correcting spelling mistakes are important.

Source: Parker, R. C. (1990). *Looking good in print* (2nd ed.). Chapel Hill, NC: Ventana Press.

produce their publications. A more do-it-yourself approach involves consulting a text in desktop publishing design, such as the ones by Parker (1988, 1989, 1990) and Stanley (1989) listed in "For More Information." (See "Design Considerations," above.)

It is important to proofread the formatted document before it is printed. Many desktop publishing programs do not allow you to use the spell checker once the document has been formatted, but some programs (such as *Aldus Pagemaker 4.0*) do feature a spell checker that can be used on the final formatted document.

For More Information

Cole, M., & Odenwald, S. (1990). *Desktop presentations*. New York: AMACOM, American Management Association.

Includes extensive information on desktop publishing and design features. Compares various software programs, desktop printers. *Available from:* AMACOM, American Management Association, 135 West 50th Street, New York, NY 10020; Tel: 518/891-5510.

Felker, D. B., Pickering, F., Charrow, V. R., Holland, V. M., & Redish, J. C. (1981). *Guidelines for document designers*. Washington, DC: American Institutes for Research.

A compilation of what is known about the text of a document-based on research conducted to "make documents easier to read and understand." The authors describe 25 principles, give examples, offer common sense advice, and summarize research. Sections include principles for organizing text, writing sentences, and using type and graphics. Includes a complete bibliography.

Parker, R. C. (1988). *Looking good in print: A guide to basic design for desktop publishing*. Chapel Hill, NC: Ventana Press.

Describes the fundamentals of good design and how they can be applied to a variety of desktop publishing projects. Examples translate graphic abstracts to specific page layouts. The author shows how minor adjustments can result in major improvements in appearance. Chapters are devoted to newsletters, charts, and graphs. Books and training materials are only briefly mentioned. *Available from:* Ventana Press, P.O. Box 2468, Chapel Hill, NC 27515; Tel: 919/942-0220.

Parker, R. C. (1989). *The makeover book: 101 Design solutions for*

desktop publications. Chapel Hill, NC: Ventana Press, Inc.

This book offers 101 actual "before" and "after" examples of improved desktop publishing design using basic techniques. It shows how printed materials can be dramatically improved, often with just a few simple revisions. *Available from*: Ventana Press, P.O. Box 2468, Chapel Hill, NC 27515; Tel: 919/942-0220.

Stanley, M. L. G. ((1989). *Exploring graphic design: A short course in desktop publishing*. Eugene, OR: International Society for Technology in Education.

Offers an overview of essential principles of design and how to apply them to practical problems. Describes how to plan and produce newsletters, manuals, and books. Includes chapters on typography, type classification, and layout and design principles. *Available from*: International Society for Technology in Education, University of Oregon, 1787 Agate Street, Eugene, OR 97403; Tel: 503/346-4414 or 346-4429.

Stoughton, M. S. (1989). *Substance and style: Instruction & practice in copyediting*. Alexandria, VA: Editorial Experts, Inc.

An excellent guide to APA, GPO, and Chicago editing styles—as well as Associated Press—with examples and study exercises. *Available from*: Editorial Experts, Inc., 66 Canal Center Plaza, Alexandria, VA 22314; Tel: 703/683-0683.

A Viewpoint on

PRINT MATERIALS:

Successful Strategies for Desktop Publishing Workshops

by Judith Sweeney
University of Connecticut

We've been conducting workshops on desktop publishing for about 6 years. Over the years the workshops have evolved—teacher interest has changed and we've gotten more efficient. The following are some strategies that work for us.

Desktop Publishing as a Professional Tool

Previously, we taught *Publish It* and *News Room* to teachers so they could use those programs to help their students publish their work. However for the past 3 years we've concentrated on teaching *Pagemaker* as a professional tool for teachers. We've found that teachers want to use desktop publishing to make their own jobs easier when they develop handouts, manuals, and training materials. They are still interested in using desktop publishing with students for poetry books and flyers but that is not their main focus. Teachers really want to use it for themselves—to become better teachers.

Pagemaker has several attractive features. You can use a scanner and bring a photograph into the document very easily. *Pagemaker* lets you crop and size the photos for publication. We do color separations for our brochures with it. *Pagemaker* is as fancy as we want to get, and yet as simple as needed for a teacher who only wants to make a "Fire Drill—Stay in Line" sign for her class. *Pagemaker* gives you a lot of room to grow.

Hands-on Essentials

With desktop publishing, you can't just lecture—there must be hands-on experience. I've found that a ratio of 1 person who knows desktop publishing to every 5 people makes the class move along at a very good pace. The knowledgeable person can be a participant. For instance, at the last ConnSENSE conference workshop, among the 17 people we had 2 instructors and 3 participants knowledgeable in desktop publishing. That worked out fairly well. The best class I ever conducted had just three people—that was ideal in my mind. Every person should have his or her own computer. If you put three people on a computer, you will always have one person hanging back and never touching the keys. People don't really learn unless they do it themselves.

Some people come to our workshop with out basic computer skills. These people need to be brought up to speed on the computer, quickly, so they can catch up with the class. I'm not sure how we are going to solve this problem.

A desktop publishing workshop needs to be scheduled for more than 3-4 hours, preferably over 2 days to allow people to have time for everything to sink in.

Public Domain Starter Disk

Each person in our training session gets a disk full of text files, paragraphs, and stories. The disk also has public domain graphics and everything else that might be needed to lay on a page. It's all on one disk. The workshop participants don't waste time typing or looking for pictures. When the workshop is over, the participants can take their disks home and use the material for their own publications because everything is in the public domain.

The disks also contain templates that we have created. There's a template for making overhead transparencies, business cards, and flash cards. Written on the templates are notes for that particular tool, so the user doesn't have to go back to the workshop notes to know how to use the template. For example, on the overhead transparency template, we use a dotted line to indicate the usable space on the transparency and add notes for use at the top of the frame, such as: "Always put your information inside the box because it won't show on the overhead projector. Be sure you get the right kind of transparency film, otherwise it will go through your laser printer and come out black."

Pertinent Handouts

We try to limit the material we provide to workshop participants. We give out only one handout that's not more than 10 pages. It includes information that directly relates to our training sessions. The pages include a series of key screen pictures that illustrate exactly what we do in class. We use arrows to focus attention and give brief explanations of the procedure. We've had people call back and ask for duplicates of the handout; it seems to be valuable. It provides a simplified step-by-step explanation of the different operations. The workshop participants have already gone through the procedure once in class, the handout helps them practice it by themselves.

Basic Page Design

We teach basic page design. For instance, we talk about fonts—how to choose them and what they mean psychologically. We also teach the participants about designing for different audiences. We discuss white space and how not to be afraid of using it. Teachers want to fill up every square inch of paper, so our workshop stresses where white space can be added. The very first assignment includes an activity where they have to add white space.

A few simple rules are discussed in class. Basically we tell the class what designs are found today in many publications. For example:

1. Use san serif type for headlines, serif type for text.
2. Use an odd number of columns.
3. Make horizontal lines twice as thick as vertical lines.
4. Use twice as much white space above a new heading, as below the heading and before the text.

These are very simple rules, formulas really, but they help the participants avoid pitfalls when they are first laying out a page.

We use overhead transparencies to show pages of recent publications and then talk about their design. This presentation is done early in the workshop to get the participants thinking about design elements. We ask them if the example shows good design and if it follows the rules presented in class. If it doesn't, we ask them what they would do differently. That seems to work well. We know people are becoming aware of page design when they come in the next day with *TIME* magazine and say, "Oh, look at this. They used three columns."

Pagemaker Layers

Pagemaker allows you to "layer" elements to create a design. This is often confusing to the novice. In *Pagemaker*, for example, you can place a black box on the bottom layer and then add a second layer of a white box the same size and off to the center so that it looks like a shadow. Inside the box you can put a circle, as the third layer, and inside the circle you can put words as the fourth layer. The problem is that sometimes the novice wants to get to the bottom layer but doesn't know how. If you click on that area, there's so much stuff on top of it covering the bottom layer, you can't get

back to that layer. That is the reason novices sometimes lose their text on the screen. It is really just behind a layer.

To illustrate this concept to workshop participants, I use transparencies. I draw a black box, lay a white box on top of that, and build the layers as you would on the screen. That illustration helps them to understand. Once they can picture the layers in their mind, we can move on to the commands that allow them to go through the layers one by one.

These are some of the strategies that work for us in our workshops. Currently, we plan to introduce *Pagemaker* to high-school students in Hartford, so we may have additional insights in a year or two.

GOOD DESIGN FOR PROJECTED MEDIA

This section will help you develop effective overhead transparencies, slides, and computer presentation displays.

Good technology trainers plan most of their class sessions for student hands-on activities. Some content, however, demands a "lecture" format. Trainers often illustrate their presentations with key word outlines, charts, and graphs projected onto a large screen for the entire class to see. Overhead transparencies and slides remain popular media for projection; but many trainers are now designing visuals on the computer and projecting these frames onto the large screen.

Because projected media are so simple to use and produce, trainers often forget the design constraints for this medium and simply copy a visual designed for a different medium (see "From Print to Projection," below). Inappropriate visuals and poorly designed visuals can detract from a presentation.

I couldn't see any of the transparencies the speaker showed—the print was so small. This speaker insulted his audience. And you call him an expert?

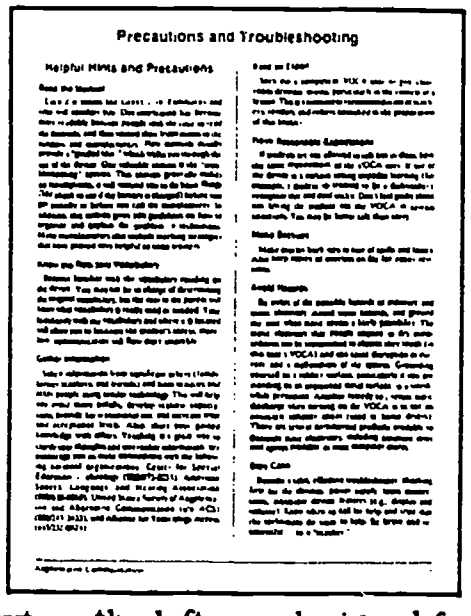
—Evaluation comment from symposium participant

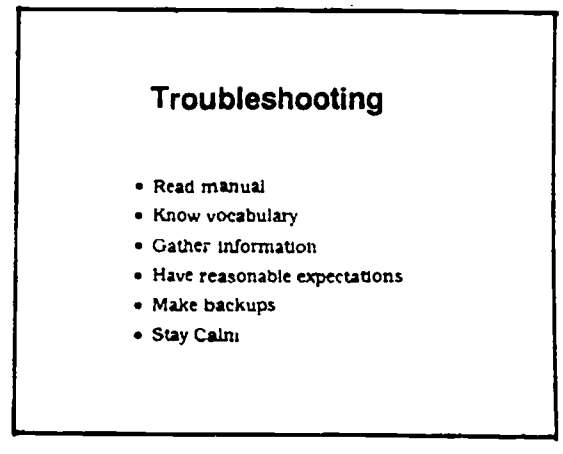
Development Steps

When designing projected media, you should follow these four steps:

* *Plan.* Decide the purpose of the presentation, analyze the nature of the audience and their information

From Print to Projection





The text on the left was designed for the printed page. The text on the right was designed for projection. Projected images need to be simpler, less complex visuals than those used in print materials.

Design Tips for Projected Media

- Use only key words and phrases.
- Limit text to 6-7 words per line, 6-7 lines per slide.
- Use capitals and lower case letters, instead of all capitals.
- Use lettering readable at 10 feet (type size no smaller than 18 point).
- Use charts and graphs whenever appropriate.

Source: 3M. (n.d.). 3M transparency preparation guidelines. St. Paul, MN: 3M.

needs, and determine what topics will be covered.

* *Draft-Write-Sketch*. Draft lecture notes and sketch visuals.
* *Produce Visuals*. Render the artwork, take the photographs, and, as needed, program the computer.
* *Evaluate and Revise*. Try out the presentation with its illustrative visuals and revise both, based on tryout feedback.

Presentation Planning

As you outline the content of the presentation, prepare thumbnail sketches and possibly even storyboard visuals. Plan the visuals at the same time as the oral presentation to make sure they are an integral part of your presentation. Don't go overboard on visuals, however; projected visuals are not meant to carry the content of the entire lesson. They are used to highlight important points and clarify or illustrate concepts.

Visuals can be text (word) frames, charts, graphs, diagrams, illustrations, and photographs.

Text Frames

All too often trainers produce visuals from printed copy. This is a major error as the visual is difficult to read and projects poorly. Projected visuals need to be bolder and simpler than visuals for printed materials. Simplicity is important for text frames; keep text to a minimum. Use keywords, not entire sentences, to emphasize and organize main points of the presentation. Legibility is also important. *Remember: Printed text needs to be large enough to be seen from a distance.* (See "Design Tips for Projected Media," above, for several rules of thumb for limiting the amount of text on a visual to enhance readability.) Try out every visual before your presentation. Project it and then sit where your audience will sit to see if the text is legible.

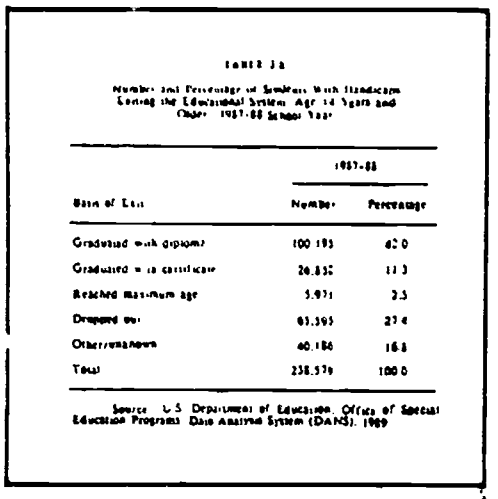
Charts and Graphs

Charts and graphs illustrate what the trainer is saying. A table of numbers takes time to interpret. A pie chart and bar chart that contains the same numeric information is much easier to understand at a glance. When designing charts and graphs, remember that lines should be heavier and thicker than those used for printed materials. The number of elements in a chart needs to be limited, for example, only 6 slices for a pie chart, a maximum of 12 bars for a bar graph (see "Simplify Tables," below).

Color

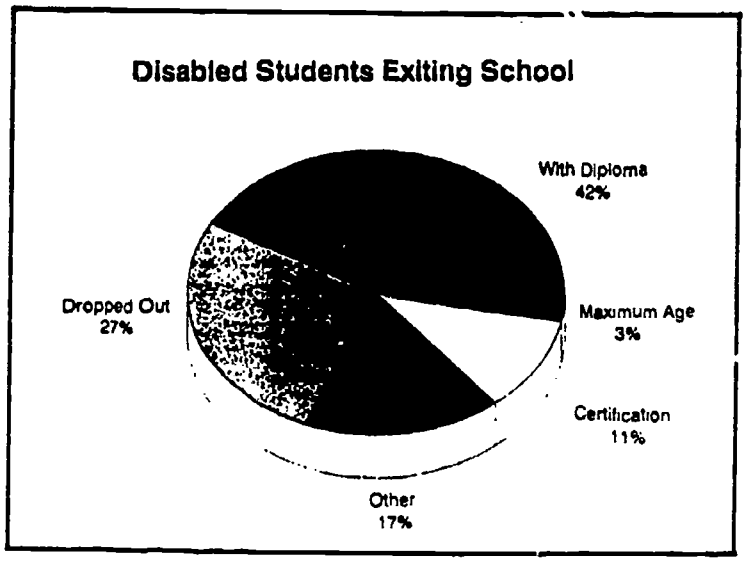
Color often adds clarity but it is best to go easy on this element. Learn which colors work together best and which colors

Simplify Tables



Basis of Exit	1987-88 Number	1987-88 Percentage
Graduated with diploma	100,193	42.0
Graduated with certificate	26,835	11.3
Reached maximum age	5,971	2.5
Dropped out	63,393	27.4
Other/unknown	40,186	16.8
Total	238,579	100.0

Source: U.S. Department of Education, Office of Special Education Programs, Data Analysis System (DANS), 1989



The information in the printed table on the left is converted to a graph for a projected visual at right.

to avoid (see "Rules for Using Color," and "Color Schemes," below). Color coding, to identify hierarchies and emphasis, needs to be used consistently throughout the presentation. For example, use yellow to highlight, blue to indicate second items in priority. However, include some other element (bolding, different size type) besides color coding to aid color-blind viewers.

Consistent Style

Good presentations have visuals that maintain graphic consistency, rather than mix several art styles. An advantage of slides and overhead transparencies is that they can be designed for one presentation, rearranged, and used another time. Be careful when recycling visuals for a new presentation, however, to make sure the art styles and type fonts of the various frames are compatible.

One final note on reusing visuals: Slides, overhead transparencies, and video visuals are all slightly different-sized rectangles. Slides have a 2:3 aspect ratio (height to width); video, a 3:4 ratio, and transparencies, a 4:5 ratio (although they can be a vertical 5:4 ratio, as well). If you intend to use a visual in more than one medium, design for the primary medium and add a margin (called a "bleed") around the visual to accommodate for cropping in the other formats. Also, each medium varies in its capacity to record detail; print medium accommodates the most detail, then slides, overhead transparencies, and finally video. It is a good idea to design for the least precise medium you will encounter (video) and then reuse the design in the more precise media with no problem.

Slides

Slides provide high-definition, colorful visuals. Slide photos, shot on location, add realism not available through graphic design. For example, photos can simulate a field trip to a classroom or at least show what a device looks like and how it is used.

You can design slide art on the computer using a word processing, desktop publishing, or graphics program. The chart or graphic is stored on disk and

sent to a computer slide service to be converted into a 35-mm slide.

Electronic Presentations

You can use the computer to plan and present a lecture. Electronic presentation software allows you to

* Plan the lecture and write your speech
* Create lecture notes
* Prepare handouts
* Design and produce visuals to project (charts and graphs)
* Project visuals during the presentation

Effective computer presentation visuals should follow the same guidelines as other projected media (e.g., limit the number of lines and words per frame, be cautious of color). But you can add some special effects to the computer graphics. For example, you can add computer sound. And you can cue visuals so that when you go from one visual to the next you can use special types of transitions—dissolves, wipes, venetian blinds, and so forth (see Mary Anderson's Viewpoint, "Hooked on *HyperCard*", below).

Computer images are projected by linking the computer to an overhead projector via a liquid crystal display (LCD) projection device. The LCD panel is placed right on top of the overhead projector. Currently, LCD projection panels are monochromatic or have limited color display.

Rules for Using Color

- Use bright or warm colors in small areas with large cool areas as background. Warm colors are red, orange, yellow. Cool colors are violet, blue, green.
- For text frames, you can use either light text on a dark background or dark text on a light background. Both provide good contrast.
- Blue and black are the best background colors for text frames. Other good backgrounds are gray, brown, green, purple. White and yellow are the best text colors with dark backgrounds.
- Don't use red and green together for emphasis because viewers with red/green color blindness cannot distinguish these colors.

Color Scheme Rules

- *Monochromatic* schemes use one color with tones varying in hue and saturation (e.g., blue, dark blue, light blue).
- *Analogous* schemes are 2 to 4 colors adjacent to each other on the color wheel (e.g., red, red violet, violet, blue violet). If 2 colors are used, use both with full intensity. If 4 colors are used, use only 2 at full intensity, keep the other 2 at different values.
- *Complementary* schemes are opposite colors on the color wheel (e.g., orange and blue). Make 1 the dominant color, accent with the second color in smaller places.
- *Triadic* schemes use three colors equidistance on the color wheel (e.g., red-blue-yellow). You can use all 3 at full intensity, but it's better to use 1 at full intensity and the others lighter and darker.

Source: Cole, M., & Odenwald, S. (1990). *Desktop publishing*. New York: AMACOM, American Management Association.

However, there are a few, more expensive video projection systems that give you wide color ranges. Another option for projecting a computer screen would be to connect the computer to a large TV monitor.

For More Information:

Cole, M., & Odenwald, S. (1990). *Desktop presentations*. New York: AMACOM, American Management Association.

Provides a brief overview of desktop presentation capabilities, then illustrates how various software and hardware can help you develop materials. Presents guidelines for overheads and electronic slide shows; includes a discussion of the use of color in presentations. *Available from*: AMACOM, American Management Association, 135 West 50th Street, New York, NY 10020; Tel. 518/891-5510.

Kemp, J. E., & Smellie, D. C. (1989). *Planning, producing, and using instructional media* (6th ed.). New York: Harper & Row.

Updated classic on how to produce instructional media of all types (sound or print, motion or still pictures). Provides a "nuts-and-bolts" approach to production, heavily illustrated. This new edition gives greater emphasis to learning theories, interactive media design research, and microcomputer equipment and programs. Procedures for preparing graphics, making overhead transparencies, and desktop publishing receive detailed treatment and videodisc production. *Available from:* ASTD, 1630 Duke Street, Box 1443, Alexandria, VA 22313; Tel: 703/683-8129.

Mezey, P. (1988). *Multi-image design and production*. London: Focal Press.

Provides information on creating 1-, 2-, and 3-projector productions. Leads you through the entire production process from planning and preparing scripts, visuals, and soundtracks. *Available from:* ICIA, 3150 Spring Street, Fairfax, VA 22031-2399; Tel: 703/273-7200.

Rabb, M. (Ed.). (1990). *The presentation design book: Projecting a good image with your desktop computer*. Chapel Hill, NC: Ventana Press.

Helps users of desktop presentation technology produce professional-looking and persuasive slides, overheads, graphs, handouts, screen shows, and other presentation media. Individual chapter on text frames, graphs, and color provides examples of good design. *Available from:* Ventana Press, P.O. Box 2468, Chapel Hill, NC 27515, Tel: 919/942-0220.

Simpson, R. S. (1987). *Effective audio visuals: A user's handbook*. London: Focal Press.

Different types of presentations from traditional flipcharts to the latest interactive and computer-aided technology. *Available from*: Focal Press, 80 Montvale Avenue, Stoneham, MA 02180; Tel: 617/438-8464.

A Viewpoint on

PROJECTED MEDIA:

Hooked on HyperCard

By Mary Anderson
Center for Special Education Technology

You might get hooked on *HyperCard* as I did, by creating a stack of text frames to use as overheads for my presentations. After mastering text frames, I went on to embellish my presentations with graphics, audio, and video, but I'm getting ahead of my story.

Getting Started

I learned how to use *HyperCard* by following George Beekman's (1990) book, *HyperCard in a Hurry*. I also observed other peoples' stacks and adapted their ideas.

HyperCard runs on the Macintosh computer. It's a kind of software "erector set" for building applications. *HyperCard* is a tool that allows me as a trainer to design screens with large, dark letters that can be projected onto a wall screen with an LCD projection device. As I design an individual text frame, I experiment with different text fonts as well as with features such as bold, underlining, and italics, before deciding which is the most appropriate for my message.

I can present information in a linear fashion just as I do with overhead transparencies. But I can also include information in a nonlinear fashion. Information on one frame is linked to other frames. You just click the mouse on a curser-sensitive area (called a "button") to bring up examples and information on related topics instantly. This nonlinear fashion of presenting information is characteristic of *HyperCard*.

Adding Art, Sound, and Video

Drawings, clip art, scanned-in photographs, and animation can be added to text frames. I like to add a drawing on each screen because these effects give a sense of movement from one screen of information to another.

I have frequently added sound to my presentations through the *MacRecorder*, a tape recorder for the computer. I simply record my voice, music, or other sound effects onto any of the cards in my presentation stack. *Macintalk*, a public domain software, is another add-on that gives you synthesized speech. With *Macintalk*, when the user types a word or a sentence, he or she hears it spoken.

Video can be incorporated by using a driver such as *LectureMate* to display photographs or motion video on an adjacent screen. For $1,100 a video digitizing card can be installed inside the Macintosh that enables the video to be viewed on the same computer screen as the rest of your information. With the LCD it can all be enlarged and viewed by a large audience. Adding CD-ROM extends the resources of *HyperCard* programs even more.

Model Effective Use

As a trainer, you owe it to your students to model good technology use. By using *HyperCard* —and your imagination—you not only convey information to your audience but you demonstrate an effective use of technology.

Sources:

Beekman, George. (1990). *HyperCard in a hurry*. Belmont, CA: Wadsworth Publishing Company, 10 Davis Drive, Belmont, CA 94002; Tel: 415/595-2352.

LectureMate. Charity Ware, Learning Technology Center, Peabody College, Vanderbilt University, Box 328, PCVU,

Nashville, TN 37203; Tel: 615/322-8186.

MacRecorder. Farallon Computing, 2150 Kittredge Street, Berkeley, CA 94704; Tel: 415/849-2331.

Macintalk. Public domain software UK Disk #2491. Available through Kentucky Special Education Technology Training Center, c/o Margeret Shuping, Department of Special Education, 229 Taylor Education Building, University of Kentucky, Lexington, KY 40506-0001; Tel: 606/257-4713.

245TV Video Digitizing Card. Raster Ops, 2500 Walsh Avenue, Santa Clara, CA 95051; Tel: 408/562-4200.

GOOD DESIGN FOR VIDEO

This section gives you some suggestions on how to write and produce videotapes.

Video materials can assist you in illustrating a lecture or highlighting information. For example, a video segment can show how an environmental control unit is used by a student. It can also bring to life a case study, for example, following a student from assessment for an assistive device to eventual classroom use of the device.

With camcorders readily available and the emergence of desktop video editing through the computer, you now have the option of producing your own videos. Video production usually takes two routes: the local, camcorder production and the full-blown, professional studio production. However, before embarking on a production, consider the final audience. Will the video be used only for your own classes or distributed throughout the district, state, or nation? If you do plan a wider distribution, go for a more commercial production, as home-generated videos don't copy well. They produce poorer copies than the original.

Developmental Steps

Good video design begins with following a comprehensive planning and production process:

* *Plan.* Determine the purpose of the video, analyze the audience, identify general content, and draft a treatment.
* *Write-Draft-Revise.* Write the script, storyboard key scenes, and review and revise the script.
* *Produce.* Set up locations for the shoot, tape both on location and in the studio, and edit and assemble the master tape.
* *Evaluate and Revise.* Try out the video on potential student audiences and re-edit and re-shoot, based on the audience feedback.

Planning

Planning is critical to ensure that the video produced will satisfy your training needs and those of your students (see "Video Development Steps," below). Time spent in the early stages of planning and preproduction activities may even cut production time because the time you spend defining what the video will include and organizing the shooting can lead to a more efficient production.

One planning tool is the treatment. The treatment is a three- to four-paragraph narrative that briefly summarizes how the story will be told. It includes the visualization of the opening scene, a general description of the narrative flow, and highlights of key visuals. Several different treatments may be developed from the same content outline, each telling the "story" from a different point of view (see "Generic Story Formats," below). From all of these treatment ideas, one is chosen.

A treatment is a good communication tool because it crystallizes the story line and is shorter and easier to read than the final script. At this stage, you can easily change the concepts, visuals, and tone of the program. Changes made later during production are more costly.

Video Development Steps

Plan

1. Determine purpose and objectives of video.
2. Analyze audience needs and existing knowledge.
3. Research locations and visuals.
4. Write content outline.
5. Write video treatment.

Write and Revise

6. Write the script.
7. Storyboard key sequences.
8. Review script.
9. Revise script.

Produce

Preproduction

10. Determine shooting schedule.
11. Hire actors/narrators as needed.
12. Hire production crew and arrange production equipment.

Production

13. Tape segments-location and studio.
14. Produce graphics, titles and tape these segments.

Postproduction

15. Assemble video segments and edit.
16. Record voice over narration, music and other audio.

Evaluate and Revise

17. Try out video.
18. Re-shoot/ re-edit segments as needed.

Scripting

Good scripts include enticing openings that capture the attention of the audience, creative story lines, exciting visuals, and narration written conversationally for the ear. Writing can be contracted out—but of all the production steps, script development is the step in which your input as a trainer is crucial. The script should be finished before any production is begun. Also, any script approvals should be obtained before production.

While the script is still in draft form, many writers often prepare a storyboard, which illustrates key scenes, transitions, and major graphics. A storyboard is a good vehicle for communicating what the finished video will look like. It can also clarify any graphics that will be included in the program.

Production

Production is the actual shooting of the video. Before you shoot any scenes, however, you must gather props, select locations, and recruit actors. You then need to develop a shooting schedule. If you will be documenting action in a classroom, build in extra production time and backup sites. Students and teachers may not provide the action you want on the first try. Organize all shots involving children to be done in the morning when they are at their best, even though that means that some shots will be out of sequence.

All people recognizable on the tape must sign photographic release forms allowing their image to be shown. For any dramatic action, use professional actors. Audiences are accustomed to highly polished commercial productions by professionals. Anything less will affect the quality of the final product.

Trainers find that by using today's high-quality home camcorder equipment, they can produce video programs that mimic professional videotapes. Do-it-yourself productions are excellent for capturing spontaneous classroom activity that can be used later to illustrate a concept.

However, even though videotaping and editing equipment expand what you can

Generic Story Formats

Some standard video formats include the following:

* *Talking head*—on screen person talking (e.g., the university president).
* *Talking head with props*—on screen person demonstrating action (e.g., Julia Child's cooking program).
* *Visuals and voice*—mixture of visuals such as stock footage, historical photos, animation and voice over (off screen) narration.
* *Interviews*—half-scripted conversations with on screen (or off screen) person.
* *Dramatization*—story with emphasis on human interaction.
* *Mixture of these formats*—usually video uses more than one format.

Source: Van Nostran, W. (1983). *The nonbroadcast television writer's handbook.* White Plains, NY: Knowledge Industry Publications.

create on your own, you must still pay particular attention to basic production details: sound, lighting, and camera movement during the actual taping. No amount of special effects can compensate for a poorly lit scene, shaky camera movements, or inaudible sound (see "Camera Guidelines," below.

Graphics

Video graphics follow design rules constrained by the TV screen. Graphics need to be bold, simplified, and centered in the middle of the frame—that is, the "TV safe" area—to prevent image dropoff at the curved edges of the screen (see "TV Graphic Guidelines," below). Still photos or slides are low-cost alternatives for TV visuals. You need to be careful, however, when using slides as TV visuals, because they have a different aspect ratio. Some cropping of the slide picture will occur.

Audio

Narrators, both on screen and voice over, should be professionals. Voice over (off screen) narration is a skill not all actors (and certainly not most nonactors) possess. The scripted words need to be spoken in time to fit the action and be appropriate to the action. A studio will usually help you select one of several narrators who regularly work with the studio.

In addition, music and sound effects add character and polish to a production. If you are working with a sound studio, it will usually have a library of low-cost music segments that can be inserted for transition between scenes. If you are mixing your own audio track and use copyrighted music, you need to request permission to use the music.

Special Effects

During postproduction activities, the tape segments are assembled to form the finished program. You can incorporate many special effects into the video as the action moves from one scene to another. These effects include wipes, flips, and tumbles. If you are editing the tape yourself, there are several desktop video systems available to give you these special effects and lettering for titles.

Professional Productions

If you contract with a production group, you will probably work with a director or producer/director. This person will be re-

Camera Guidelines

Basic Camera Shots

Long Shot (LS) - a general view of the setting.

Medium Shot (MS) - a closer view of the subject.

Closeup (CU) - a concentrated view of the subject, or part of the subject.

Extreme Closeup (ECU) - an even closer concentration or the subject.

Tips on shot sequence:

- A standard sequence is LS-MS-CU.
- After several close ups, use an MS or LS to reestablish the subject to the viewer.
- Change the angle of the camera after a series of LS-MS-CU sequences to provide variety.
- Use a variety of shots.
- Shoot scenes slightly longer than actually needed, to aid editing.

Basic Camera Movements

Tilt - moving the camera up or down vertically.

Pan - moving the camera across from one side to the other side.

Zoom - moving the lens from a long shot to a closeup or vice versa.

For any of these movements:

- Use a tripod for a smoother movement.
- Start or stop a moving shot with the camera held still for a few seconds.
- With a moving shot, have the camera "lead" the subject.
- Rehearse motion shots first before taping.

Source: Kemp, J. E. (1968). *Planning and producing audiovisual materials* (2nd ed.). San Francisco: Chandler Publishing Company.

sponsible for all the technical details to ensure that the program is completed with a reasonable level of technical quality. The trainer is considered the subject matter expert responsible for content decisions and the ultimate quality of the content. This requires a sharp eye during shooting and later in review of rough-cut versions of the tape. Aesthetic decisions, after initial agreement on visual treatment, should generally be left to the production group. (See Colleen Haney's reflections in "Working with a Video Production Company," at the end of this chapter.)

For More Information

Blank, B., & Garcia, M. R. (1986). *Professional video graphic design: The art and technology*. White Plains, NY: Knowledge Industry Publications.

Features numerous examples of graphics. Focus is commercial news, but does provide both artistic and technical guidelines for any video graphics. Includes information on computer-generated graphics. *Available from:* Knowledge Industry Publications, Inc., 701 Westchester Avenue, White Plains, NY 10604; Tel: 800/248-5474.

Brown, M. (1991). *Desktop video production*. Blue Ridge Summit, PA: Tab Books.

Addresses how to combine video technology with the personal computer. Includes animation, presentation graphics, and training videos. Summarizes hardware and software possibilities, edit controllers, and video digitizers. *Available from:* Tab Books, Blue Ridge Summit, PA 17294-0850; Tel: 800/822-8138.

Compesi, R. J., & Sherriffs, R. E. (1985). *Small format television production*. Boston: Allyn & Bacon.

This basic TV production reference, with a do-it-yourself twist, concentrates on field production with portable cameras. Describes how to add visuals with one camera and contains information about lighting, time codes, sound, and shot composition. Gives hints for shooting cutaways, material for transition, and editing for continuity. *Available from:* Allyn and Bacon, Inc., 7 Wells Avenue, Newton, MA 02159; Tel: 617/964- 5530.

DeLuca, S. M. (1990). *Instructional video*. London: Focal Press.

Handy guide to the design, development, and production of video for teaching. Guides the reader through selecting a topic, scripting, casting, developing a storyboard, and setting up studio or location shooting. Includes examples of production logs, storyboards, scripts, and schedules. *Available from:* Focal Press, 80 Montvale Avenue, Stoneham, MA 02180; Tel: 617/438-8464.

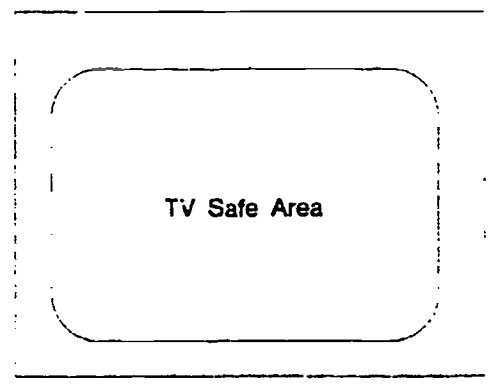
Millerson, G. (1987). *Video production handbook*. London: Focal Press.

Explains the entire process of low-cost video making. Demonstrates the versatility, techniques, applications, and aesthetics of the video format through clear diagrams and relevant examples. Covers both studio and location operations. *Available from*: International Communications

TV Graphic Guidelines

When designing visuals for video, use these guidelines:

- Use bold simple graphics—coarser than for slides.
- Avoid fine, intricate graphic detail.
- Use lines thick enough to be at least 2 pixels wide.
- Use san serif type faces; use large, generous spacing.
- Avoid red, magenta, and pure white.
- Allow for a 10% safe margin around the entire outside edge of the visual to allow for the curving of the picture.



- Keep visuals on screen long enough to be read.
- Limit lists of text to 4 to 5 lines, containing no more than 3 to 5 words each.

Sources: Rabb, M. Y. (Ed.). (1990). *The presentation book*. Chapel Hill, NC: Ventana Press. Kemp, J. E. (1968). *Planning and producing audiovisual materials* (2nd ed.). San Francisco: Chandler Publishing Company.

Industry Association, 3150 Spring Street, Fairfax, VA 22031-2399; Tel: 703/273-7200.

Van Nostran, W. (1989). *The scriptwriter's handbook: New techniques for media writers*. White Plains, NY: Knowledge Industry Publications.

Covers all phases of video writing. Gives details on how to analyze the audience and research the story. The author discusses what the treatment should include and gives many examples of how to visualize the program. *Available from:* Knowledge Industry Publications, Inc., 701 Westchester Avenue, White Plains, NY 10604; Tel: 800/248-5474.

Wells, M. (1990). *Desktop video*. White Plains, NY: Knowledge Industry Publications.

This practical guide shows you how to use the new technology and software to do tasks that would previously have been done manually or with more expensive equipment. Defines terms, includes how to purchase systems, and describes interfacing desktop video. *Available from:* Knowledge Industry Publications, Inc., 701 Westchester Avenue, White Plains, NY 10604; Tel: 800/248-5474.

A Viewpoint on

VIDEO:

Working with a Video Production Company

by Colleen Haney
Pennsylvania Assistive Device Center

We contract with a production company for our videotaping and editing. For the past 6 years, we have worked with a small Pittsburgh company—Pittsburgh Televideo. Because of the relationship that we have developed over the years, the owner and camera man know what we are looking for. They know how to work with the students and how to tape the assistive devices. They can anticipate which angles might work best.

Initial Planning

Before contacting Pittsburgh Televideo, the staff and I start with a brainstorming session to determine the important issues of the topic; clarify the concept, goals, and purpose of the tape; determine who the target audience will be; what the message is; and set the focus of the tape. At this time, we also attempt to determine the best length of time of the tape to suit the audience.

During this initial meeting, we begin to outline the segments of the tape. For example, there may be four segments: the opening that focuses on heightening awareness, the introduction that sets the stage, the main part that provides an in-depth treatment of the subject, and finally, a wrap up and review of the important thoughts or items.

We know what we want to highlight during the taping, based on the detailed outline. But we are not strict about preparing a storyboard and full script before taping because we also rely to a certain extent on what happens spontaneously when we go out in the field.

That's why working with Pittsburgh Televideo is a plus because the cameraman already knows in general how we want to approach the project. I sit down with him and discuss the kinds of shots/video we want. During this time we usually discuss the technical aspects, such as what is technically possible—what can be done, what can't be done, which camera angles are needed, etc. We resolve these production and technical issues and problems early in the planning stage.

Arrangement for the On-Site Shooting

We book Pittsburgh Televideo for the amount of time we expect the shoot to take. I also make arrangements with the schools, students, and clinicians who will be on camera and get their signed permission slips before the actual shooting.

The Day of the Shoot

We sit down briefly with everyone, introduce the production crew, and explain what the goals of the taping are and what we are attempting to tape. In some instances, we don't tell people exactly what we are hoping to tape because we don't want to lose the spontaneity.

We work with just one camera because it is cheaper than having two or three, and we try to be as unobtrusive as possible when we go on location. We don't want to barge into classrooms and overwhelm the students with extra equipment. So we just take a few lights and one camera. As a result of using just one camera, we go through a situation once and then get additional shots for edits later. For example, if we're taping an interaction strategy in the classroom, we usually tape the situa-

tion and then go back to get closeups and different camera angles for edits.

As the taping proceeds, I'm responsible for keeping track of what video we get and what shots or footage need to be added for edits. The cameraman is a big help because he often suggests different camera angles and movements. He is also sensitive and understands how we want the students portrayed. He knows we want to see the kids at their best. He's very conscious of whether their hair is neat, their clothing smoothed—including the students who may be drooling or awkwardly seated in their wheelchairs due to severe physical disabilities.

Postproduction Editing

The production company sends us the raw footage with time codes. We go through the entire set of tapes and log all of the video and audio so that we have a written description of all the video segments (see Figure 2 below).

We study the log and decide how closely it fits with what we had originally planned. Then we start writing the narration or script. At this time we select the actual video or audio sections from our time coded log and layout the entire tape on paper.

When the script is ready, I personally go back and work with the video company's editor and lay the footage down. The editor helps pace the program. For example, as an outside observer, he may see a segment such as the demonstration of adjusting a head piece for a light pointer and say, "That's really nice, but it's too long for the audience to look at this one shot. Why don't you break it up with some edits, show some closeups, show the child again, or go back to the adult?"

The production company also provides a narrator and adds titles and other graphics with a character generator. Adding graphics is where we really rely on the expertise of the production company. I take some working drafts of what I want, such as a sketch of a chart. Then the video editor "fine tunes" the visuals—cuts words, adds color, makes it more visually appealing. The editor will suggest different visual effects to fit the program topic and the capabilities of his equipment—adding color, enlarging print, twirling images. These touches add a professional look to the show.

Figure 2

20:46:24	Edinboro sign in trees with building in background (could be a still shot as well)	
24.10 06	Jenny and peer in dorm room - right profile of Jenny	
	Video only - Jenny and peer talking	
25.02.01		Peer talking "We have to stop B S ing about" what are we doing
. :5:00		Jenny responds you will have to help me get the quotes
28:38.25	Close up of computer monitor with Jenny's work	
28 50.18	Begin pan from computer monitor to full of Jenny and peer	
29.28.19	Close up of device over Jenny s right shoulder	
29:43.10		Jenny speaks about the note-card she needs
32:12:17	Close up of wireless data transmitter	
32:27.21	setting up wireless system with computer	

Excerpts from a Video Log

GOOD DESIGN FOR COMPUTER INSTRUCTION

This section gives you some design suggestions for developing computer instruction materials.

Trainer-created computer programs have many uses. For example, you may design simple tutorials to guide resource room teachers through a newly created software program for an individualized educational program. Or you may design a simulation to enhance the decision-making skills of team members who are working on assistive technology assessment.

In the past, trainers would not consider designing computer instruction because the process was too time consuming. Now easy-to-use "authoring" programs are on the market that make creating your own lesson a reasonable task.

Even though authoring programs save time, production of computer-assisted instruction (CAI) programs still requires a substantial time commitment from the trainer.

This section discusses using the computer to bring instruction directly to the student—on a one-to-one basis. Designing projected materials and using the computer to help trainers present visuals during a lecture is discussed in the section, "Good Design for Projected Media."

Development Steps

In developing CAI, consider the following four steps:

* *Plan.* Determine the lesson purpose, identify student prerequisite skills, delineate steps of the task to be learned, generate ideas, and organize the lesson.
* *Write and Draft.* Flowchart the lesson, write the individual screens, sketch visuals, try out parts of the lesson, and revise as needed.
* *Produce.* Program the lesson, produce screen visuals.
* *Evaluate and Revise.* Try out the entire lesson and revise as needed.

One popular model is Alessi and Trollip's 10-step production process (see "Alessi and Trollip's Revised and Expanded Model" below).

Effective Instruction

Computer instruction materials do more than just supplement your lecture—they are self-contained and they take on some of your instructional tasks. Thus, when you design these materials, you should incorporate effective teaching elements:

* Attention to prerequisite skills.
* Modeling.
* Guided practice.
* Independent practice.

Though these elements have been found to be effective for instruction of children, they apply to adult instruction as well.

Screen Design

Screen design is based on the capacity of the computer to process and display information. The screen is usually divided into *functional areas* for text presentation and student response and *feedback areas* that remain consistent throughout the program. Symbols are designed for

Alessi and Trollip's Revised and Expanded Model for Developing Computer-Based Instructive Materials

Preparation

1. Determine needs and goals.
2. Collect resources.
3. Learn the content.
4. Generate ideas.

Design

5. Design instruction:
   a. Elimination of ideas.
   b. Task and content analysis.
   c. Preliminary lesson description.
   d. Evaluation and revision of the design.

Flowcharting

6. Flowchart the lesson.

Storyboard

7. Storyboard displays on paper.
   a. Write and revise primary text.
   b. Write and revise secondary text.
   c. Produce storyboards.
   d. Check the fit of overlaying displays.
   e. Draw and revise graphic displays and plan other output.
   f. Check graphics and simultaneous text for fit.
   g. Review the flowcharts and storyboards.

Programming and Support Materials

8. Program the lesson.
9. Produce supporting materials.

Evaluation

10. Evaluate and revise.

Source: Alessi, S. M., & Trollip, S. R. (1991). *Computer-based instruction: Methods and development.* Englewood Cliffs, NJ: Prentice-Hall.

their easy interpretation and consistent use throughout the lesson (Heines, 1984) (see "Screen Design Fundamentals", and "Rules of Thumb," below).

Flowcharting and Storyboarding

Flowcharting is an important step in designing a CAI lesson. It helps the designer track the sequence of screens, branches, and responses. It acts as a communication tool for reviewers and helps document the lesson design to aid revision (see Gail Fitzgerald's "Tips on Teaching Authoring" at the end of this chapter).

Storyboarding

Storyboarding is often done simultaneously with flowcharting. The two tasks feed off each other. During this step, you sketch the pictures of the frames and write the text. This includes writing the questions, feedback, and prompts. Completed storyboards provide an excellent way for colleagues and potential students to review the program.

Authoring

After you have written the lesson, you have two options: (a) turning the lesson over to a programmer to write code or (b) programming the lesson yourself through an authoring tool.

Today, many authoring software programs provide prompts to assist you generate programs without having to actually write computer code. *HyperCard* software tools are authoring systems. These and other icon-based authoring systems are usually the easiest to use. They have pull-down menus that guide you through the process of writing. Language-based authoring systems are harder to master, but some trainers find these programs more precise and easier to use to create their particular CAI lessons. Some authoring systems offer a combination of both icon- and language-based programming so you

can switch between the two features as needed.

Evaluation

You need to plan evaluation activities throughout the lesson development, not just after you've completed the program. Trainers are often too close to the subject to see weaknesses of the instruction. What is obvious to you is not always obvious to the student.

Evaluation can occur in several places:

* Evaluation activities can begin with collegial review of the initial lesson plan. This is after the idea generation stage, when the scope and treatment of the lesson has been decided, but before any of the lesson has been written.
* If the lesson has elements that are experimental, prepare a small portion of the lesson, program that part, and try it out on potential students. The point of this is to find flaws and fix them early. Revisions and modifications are easier to make before you write the entire lesson. Tryouts of the lesson while it is being developed are often called "formative evaluation," or alpha testing.
* After you complete the lesson, your colleagues and some students should review it. Attend to all comments. If the program will be distributed widely, a more extensive field-testing phase is needed. Evaluation of a completed lesson is called "summative evaluation," or beta testing.

For More Information

Alessi, S., & Trollip, S (1991). *Computer-based instruction: Methods and development* (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Provides step by step instruction on how to design a lesson. Discusses flowcharting, programming, lesson evaluation, and revision. Contains much practical advice and many examples. *Available from:* Prentice-Hall, Inc., P.O. Box 500, Englewood Cliffs, NJ 07632; Tel: 201/592-2000.

Davis, K., & Budoff, M. (1987). *Using authoring in education*. Cambridge, MA: Brookline Books.

Concentrates on authoring. Chapters are included on how to introduce teachers to authoring. Includes sample workshop agendas for training on authoring. Includes an extensive listing of authoring software and authoring languages. Uses

Screen Design Fundamentals

Organize the screen into five functional areas and use them consistently throughout the program. This aids clarity and provides continuity to program. The functional areas are the following:

* *Orientation information.* Similar to header on printed page. Information is there if the student wants it, but it doesn't interfere with overall presentation.
* *Directions.* Tells the student what is expected.
* *Responses.* Allows space for student to answer.
* *Error messages.* Small space, messages are short and to the point.
* *Student options.* Gives students other options, such as *help*, or *exit.*

Source: Heines, J. M. (1984). *Screen design strategies for computer-assisted instruction*. Bedford, MA: Digital Press.

Rules of Thumb for Screen Design

Symbols

* Use symbols to convey distinct meaning.
* Use symbols that are easy to remember.
* Use symbols that closely match is being conveyed.
* Use symbols consistently.
* Use unambiguous symbols—not used in context of subject.
* Test symbols for clarity.
* Don't use "cute" images—they bore.

Text Display:

* Use lower case letters, not all upper case.
* Use type styles with descenders (the g, j, p, q, and y go below the line).
* Use bold, simple type style.
* Maximum 8 to 10 words per line for adult learners.
* Make lines ragged right, break at natural phrasing points.

Source: Heines, J. M. (1984). *Screen design strategies for computer-assisted instruction*. Bedford, MA: Digital Press.

examples from special education. *Available from*: Brookline Books, P.O. Box 1046, 29 Ware Street, Boston, MA 02130; Tel: 617/868-0360.

Fitzgerald, G., Baudes, D., & Werner, J. (in press). Authoring CAI lessons: Teachers as developers. *Teaching Exceptional Children*.

Discusses stages followed in creating CAI materials using a systematic instructional design and development process model. Includes examples of design approaches used by special education curriculum developers.

Heines, J. M. (1984). *Screen design strategies for computer-assisted instruction*. Bedford, MA: Digital Press.

Discusses technical aspects of screen design. Chapters are included on functional areas, visual symbols, menus, and text display. Also includes lesson logic and display logic, text editors, and graphics editors. *Available from:* Digital Press, Digital Equipment Corporation, 30 North Avenue, Burlington, MA 01803; Tel: 617/273-6287.

Kearsley, G. (1986). *Authoring: A guide to the design of instructional software*. Reading, MA: Addison-Wesley.

A practical guide to design. Describes the essentials of good screen design, user control, and response analysis. Includes chapters on how to promote interactivity testing and evaluating the lesson, estimating development costs, and timing and documenting. *Available from:* Addison-Wesley Publishing Company, Inc., One Jacob Way, Reading, MA 01867; Tel: 617/944-3700.

Steinberg, E. (1984). *Teaching computers to teach*. Hillsdale, NJ: Lawrence Erlbaum.

Good analysis of how to plan the lesson. Includes many questions to structure

trainer's planning. Practical, realistic, many examples. *Available from:* Lawrence Erlbaum Associates, Inc., 365 Broadway, Hillsdale, NJ 07642; Tel: 201/666-4110.

Wager, W., & Wager, S. (1985). Presenting questions, processing responses, and providing feedback in CAI. *Journal of Instructional Development, 8*(4), 2-8.

Summarizes content presentation guidelines as they relate to the information processing model.

A Viewpoint on

COMPUTER INSTRUCTION:

Tips on Teaching Authoring

by Gail Fitzgerald
West Virginia University

I've taught authoring of software to many special education teachers in university courses and in inservice workshops. From these experiences, I can share a few pointers on teaching authoring.

Teach flowcharting early in the course.

If you are using the mini-authoring shell programs in which most of the lesson structure is provided, there may not be a need to teach flowcharting. But if you are teaching the newer hypermedia authoring programs that have "open screens" and no inherent structure, flowcharting is a necessary skill. When using hypermedia authoring programs, the teacher sits down in front of a blank screen; there's no structure provided until the designer creates some pages and provides linkages.

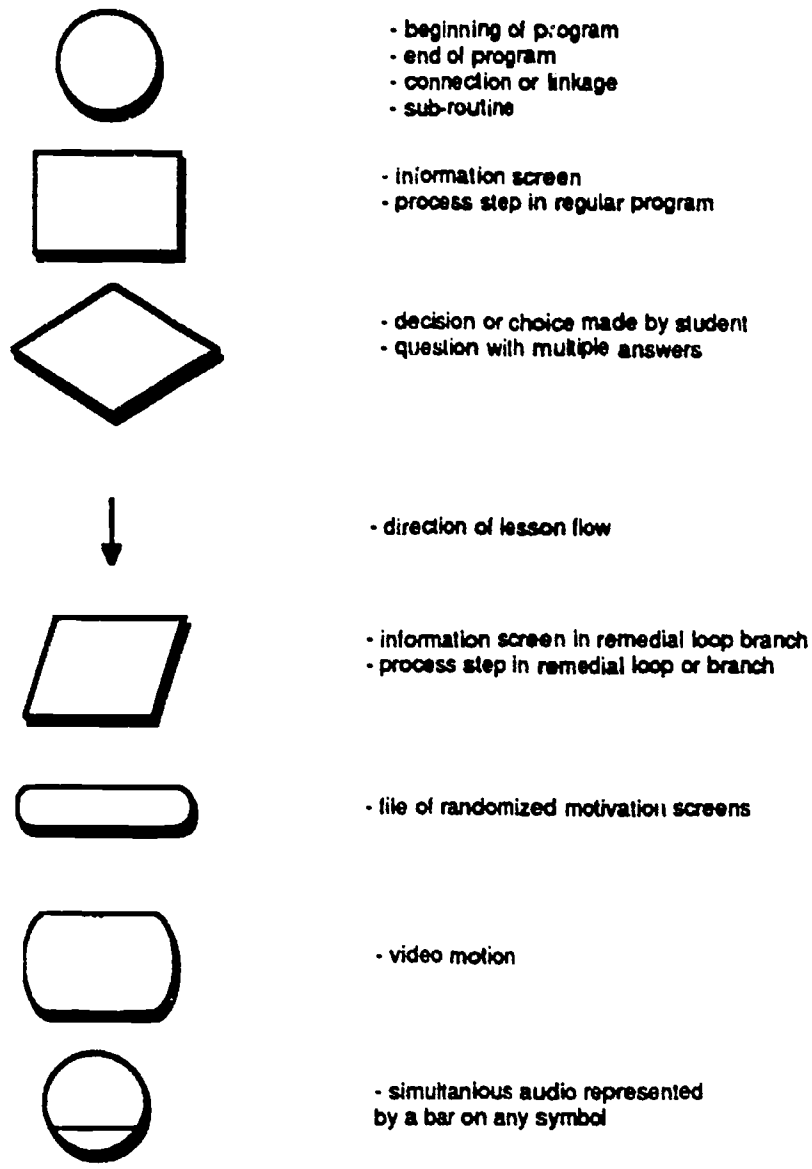
So I teach flowcharting. The flowcharting symbols I use are adapted from the standard flowchart symbols found in textbooks. I use only those that are critical to designing with the level of authoring program that I am teaching. It is less important that the symbols are the standardized versions; I am more concerned that the symbols are meaningful in the design setting and that they are used consistently (see Figure 3 below).

A flowchart is the map of the lesson. It needs to show exactly where each page is connected and how the student's responses will move him or her through the program. Thus, the flowchart not only sets up the main trunk of the lesson, but also displays all branches that the teacher wants to create for providing choices and managing student errors.

The first time I taught authoring was in a 12-day summer course of 3 weeks' duration. In the first week we focused on mini-authoring, shell programs, established the need for CAI lesson development, and started to preplan the hypermedia lessons. I introduced flowcharting on Day 3, sent the participants home the first weekend to design their lesson on paper, and make at least an initial flowchart. The next Monday they came back full of complaints—they were confused, they couldn't get their ideas into the flowchart structure, they didn't like flowcharting. Over the next 2 weeks they continued to refine their lesson structure ideas, make flowcharts, share flowcharts with each other, and create their lessons with *TutorTech*. The end-of-course feedback I received was that we should have started flowcharting earlier. They recognized it as a necessary, though time-consuming, skill, and said they were lost without their design schemas.

When teaching flowcharting, provide models with interactive lessons and accompanying flowcharts. Get the class to actually follow flowcharts, work through lessons, and discover different types of lesson structures. I believe that this hands-on experience is necessary for providing the feel of flowcharting. In the process of using flowchart models, you can teach different ways to design CAI lessons. In a very practical way, you are showing participants the differences between tutorials and simulations, drill-and-practice routines, and varieties of branching options. Indirectly, you are teaching some of the instructional design skills teachers will need for authoring their own materials.

Figure 3



Use structured labs and simulations to teach authoring mechanics.

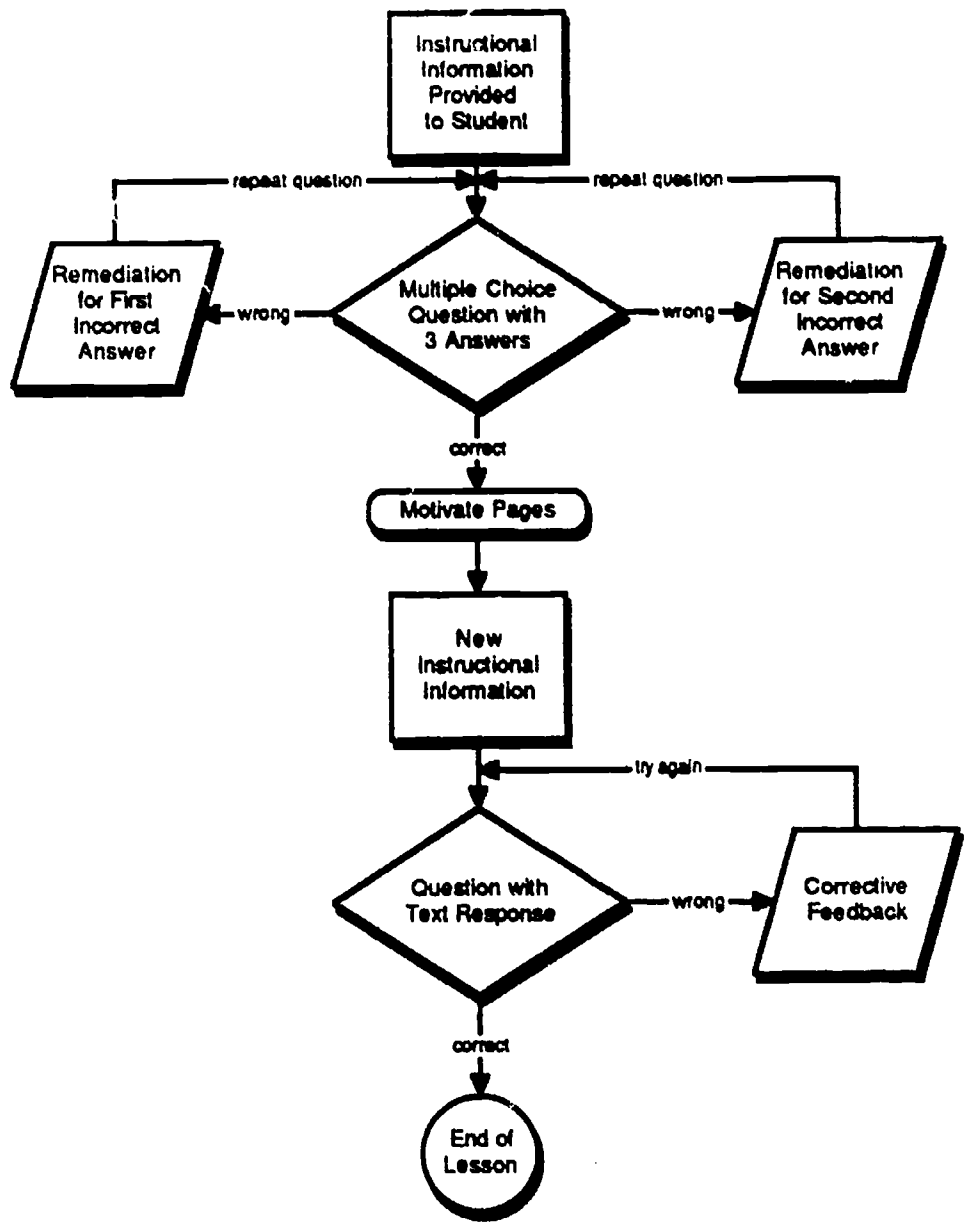
When you teach the mechanics of using an authoring program, do it in a controlled way so you can keep your group together. This is the only way to cover the content systematically. I learned this approach the hard way. When students go at their own speed, the class soon becomes one-to-one tutoring at 12-15 different levels simultaneously, depending on the number of students in the class. It's frustrating for the teacher, and instruction becomes very fragmented.

An effective way to do this is to teach through structured lab activities. I prepare lab guides with detailed, step-by-step procedures of what to do. I control what the group as a whole is doing, yet allow hands-on, individual work on computers. In this way, problem solving stays focused on the same instructional skill, and students can help each other. I have created six labs that completely teach the mechan-

ics of authoring with *Tutor-Tech*. For each lab, we do structured design simulations. For example in Lab 2, I say to the teachers: "I want you to design something very simple that's going to fit this flowchart. This is the lesson logic that we're going to work on together. Everyone's page types and button destinations must fit this flowchart." After I give them a step-by-step demonstration, they go to the computer stations and create their own content to fit the lab flowchart (see Figure 4 below).

Another way I use structure is to make simulation activities using the authoring skill being taught. One effective activity is to teach linking pages through a simulation called "Scramble." I give the class a flowchart of a very simple lesson and the computer screens for that lesson. How-

Figure 4



Lab Activity Flowchart

ever, all the buttons placed on the screens are set incorrectly. They have to change all of the buttons to get the lesson to work correctly as depicted on the lesson flowchart. With this kind of simulation activity, they can focus on the mechanics of the skill being taught without needing to struggle with their own content.

Teach screen design through interactive editing.

Many principles of screen design are used in evaluating computer-based materials. One way to teach these principles is to use a critique sheet and examine lesson screens as a group. If the instructor uses the authoring version of the program, teacher-created lessons can be loaded and viewed, with pages rearranged, deleted, or changed. Actually, I have assembled a collection of pages from teacher lessons that represent examples of effective and ineffective screen design. As suggestions for improvement are made by group members, the changes can be tried out. No other medium offers this capability for live, interactive editing. Not only does this approach teach through demonstration, but it also provides actual practice in peer review of authoring lessons—the pilot testing and revision stage in instructional design and development.

GOOD DESIGN FOR VIDEODISC MATERIALS

This section will give you some suggestions for creating videodisc training materials.

Trainer-made videodisc materials can be used to supplement lectures with visuals and audio. For example, when training resource room teachers, you might use a videodisc showing classroom segments of special education students using technology to illustrate applications of technology. Videodiscs can also be used to present interactive lessons. For example, you might use a videodisc lesson on fundamentals of the computer with preservice undergraduates to increase their knowledge of how computers work.

You can create training materials by using parts of existing videodiscs to suit your own purpose (called repurposing a videodisc). With new authoring tools, you can repurpose videodisc training materials relatively easily. Or, you can create materials by developing a new videodisc. Because creating a new videodisc is such a complex task for a novice, however, trainers usually try repurposing a few videodiscs before they go on to create an entirely new one.

Repurposing for Presentations

You can use existing discs as sources of visuals to supplement a lecture presentation. Videodisc databases, such as encyclopedias and visual almanacs can be used in this way (see "Sources of Videodiscs"). You determine which video segments will enrich the presentation.

Sources of Videodiscs

Laser Videodisc Catalog

Describes more than 100 Level 1 CAV format videodiscs in the language arts, history, physical sciences, and life sciences. *Catalog free from:* AIMS Media, 6901 Woodley Avenue, Van Nuys, CA 91406-4878; Tel: 800/367-2467 or 818/785-4111.

MECC Catalog

Describes current language arts, history, science, and National Geographic videodiscs, as well as videodisc players and utilities. *Catalog free from:* MECC Etc., 3490 Lexington Avenue North, St. Paul, MN 55126; Tel: 800/228-3504 or 612/481-3500, ext. 527.

The Videodisc Compendium

Published annually, contains more than 11,000 titles of videodiscs by 150 producers on 22 different subjects. For each title, includes description of contents, CNV/CLV, level of play, bar code access, price, appropriate grade level, hardware capability, and distributor name and telephone.

Readers can also receive 3 issues of *UPdate* which lists new titles to supplement the Compendium. Price for *Compendium* only, $20; for a year subscription to *UPdate* only $20; for both *Compendium* and a year subscription to *UPdate*, $30. *Available from:* Emerging Technology Consultants, P.O. Box 12444, St. Paul, MN 56112; Tel: 612/639-3973.

LectureMate HyperCard

LectureMate is a Macintosh *HyperCard* program that makes it easy to create presentations. It links audio, still pictures, or motion video from a laserdisc to the information you present on the computer screen. It uses Macintosh editing features, searches for video segments by frame number, and makes buttons to play selected video. As ideas and facts are displayed on the computer screen, a mouse click instantaneously provides illustrative examples or background information from the laserdisc onto another screen. *LectureMate* is particularly good for integrating images from Level 1 videodiscs into your presentations. *ClassMate* is an upgraded version of this program to be used with *HyperCard 2.0. Available from*: Charity Ware, Learning Technology Center, Peabody College, Vanderbilt University, Box 328 PCVU, Nashville, TN 37203; Tel: 615/322-8186.

then during class, merely bring up the visuals using the computer keyboard.

Authoring software makes the trainer's job easier. The software program allows you to quickly access and display the video. You can use any authoring tool software, as long as it has the ability to control the external videodisc player. Many of the *HyperCard* tools have this ability (see "LectureMate HyperCard," above). Sales (1989) describes other software presentation tools. If you use videodisc visuals to accompany a presentation, remember the graphic design principles for projected media—clarity, organization, and legibility. Design still needs to reflect the basic development steps of planning, writing and revising, producing, and evaluating materials.

Repurposing to Create Lessons

Existing videodiscs can be customized to create an entirely new lesson. When you repurpose a disc, keep in mind that design is somewhat constrained because the video images are limited to what is on the disc. However, this is usually not a great barrier, because computer graphics can be used to supplement (see "Guidelines for Visuals," below).

When designing interactive video (IVD) lessons, use the same development steps as those for computer instruction:

* *Plan.* Define the lesson and its content; determine what the flow of the lesson will be, its interaction points and screen design, and how the video will be incorporated.
* *Write and Revise.* Sequence existing video frames and develope new computer frames.
* *Produce.* Link the frames.
* *Evaluation.* Try out the lesson and revise as necessary.

Creating a New Disc

Basic principles for video production apply for videodisc production (see "Interactive Video Design Model," below). However, you should pay more attention to those parts that deal with the interactive nature of the material. For example, when casting actors, choose people who can be versatile in creating the several different conclusions of a dramatic situation that results from branching.

In postproduction editing, be careful to avoid jump cuts from one frame to the next. This is particularly taxing since the student, not the editor, controls the sequence in which the visuals will be seen. Also, during freeze frames, when the student is asked a question, the video feedback should repeat the scene that led to the freeze frame, as well as the answer.

Guidelines for Visuals

Here are some guidelines for videodisc visuals.

- Whenever possible, show things rather than use text displays.
- Show only one concept or idea per display.
- Restrict lists to 7 items or fewer per display.
- Use no more than 25 characters of text per line (for large screen-group images). Use no more than 40-45 characters per line (for individual use).
- Use combination of upper and lower case letters.
- Be consistent in the location of program control information (e.g., help comment, directions at top, advance/review, escape codes at bottom).
- Evaluate each screen display for legibility.
- Avoid crowded screens.
- Keep diagrams and drawings simple; don't include too much detail.

Source: Braden, R. A. (1986, May). Visuals for interactive video: Images for a new technology (with some guidelines). *Educational Technology*, 21-22.

This does create redundancy, but clarity and continuity are not lost.

Because discs are costly to press and cannot be revised, it is good design practice to put information that will change on the computer screen and save videodiscs for more basic, timeless information.

With so many production elements to keep track of, you need a versatile authoring tool to aid in creating your IVD program. Good authoring systems allow you to flowchart and peg individual screens to points on the chart. These systems also allow you to link the flowchart to your video storyboard and script. Storyboards and scripts can then be printed out as stand alone shot sheets and production scripts.

You should conduct pilot testing and revising on segments of the lesson at each step of the design. If some of the video can be tested before production by using storyboards and scripts, changes can be made before expensive production has begun. Comprehensive testing and revision is conducted on the finished product.

For More Information

Crowell, P. (1988). *Authoring systems.* Westport, CT: Meckler.

Compares dozens of computer packages for designing interactive videodisc programming. Explains different types of authoring and includes feature-by-feature comparisons of commercially available authoring systems. *Available from:* Future Systems, Inc., P. O. Box 265, Falls Church, VA 22040; Tel: 800/323-DISC.

Perlmutter, M. (1991). *Producer's guide to interactive videodiscs.* White Plains, NY: Knowledge Industry Publications.

A helpful and complete handbook for trainers. Contains a soup-to-nuts description of the development and production processes. This book walks the reader through the seven phases of videodisc production—project development, design, preproduction, production, postproduction, programming and validation—providing a complete sequence of steps, time requirements, necessary documentation, staffing needs, and budget parameters. *Available from:* Knowledge Industry Publications, Inc., 701 Westchester Avenue, White Plains, NY 10604; Tel: 800/248-5474.

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Interactive Video Design Model

The interactive video development process used at the University of Tennessee–Memphis is a modified instructional systems design model. The steps in this process are as follows:

1. **Topic selection**
   - Does the subject matter lend itself to interactive video instruction?
   - Is there a need for a video on this topic?
   - What is the potential for its integration in the curriculum?
   - What is its potential for national distribution?

2. **Content identification and analysis —defining the problem**
   - Defining the goals of the interactive video instruction.
   - Defining the problems that the student is to solve.
   - Identifying the specific content for the production.
   - Identifying relationships (to the smallest detail) between the different pieces of the content.

3. **Product design—making the blueprint**
   - Interaction points.
   - Feedback—immediate and summative.
   - Screen design.
   - Computer software system design.
   - Video design.

4. **Product development—writing the content components**
   - Computer programming.
   - Video—storyboarding and scripting.

5. **Production—making it and putting it together**
   - Video.
   - Computer.
   - Merging.

6. **Alpha testing**

7. **Modification and debugging**

8. **Beta testing**

9. **Distribution—including marketing**

10. **Upgrading—future changes to program/content**

Source: Singarella, T., & Ramagli. (1987, February). *Instructional uses of interactive videodisc in health sciences*. Memphis, TN: Interactive Video Project Team, University of Tennessee.

Sales, G. C. (1989, June). Repurposing: Authoring tools for videodiscs. *The Computing Teacher, 16*(9), 12-14.

Describes how repurposing can be used by trainers; includes uses for presentations, testing, and lessons. Lists several authoring tools.

Schwier, R. (1988). *Interactive video.* Englewood Cliffs, NJ: Educational Technology Publications.

A primer on interactive videodisc courseware design. Describes design, production, and premastering activities through final review and approval of the finished program. Includes a glossary, an extensive reference section on publications, a directory of manufacturers, and a sample interactive video program. *Available from:* Educational Technology Publications, Inc., 720 Palisade Avenue, Englewood Cliffs, NJ 07632; Tel: 201/871-4007.

A Viewpoint on

VIDEODISCS:

Using Video Interactively in Your Class

by Ted Hasselbring
Peabody College, Vanderbilt University

At Vanderbilt, we use video technology to anchor knowledge. That is, when we talk about a concept with undergraduates and graduate students we anchor the concept by linking it to examples the students might see in a special education classroom. We do this through contextualized multimedia environments. With a contextualized learning environment, the instructor provides the example or the context and says, "Now, here's what I'm talking about" so that you have a shared context. The reason we do this is that a group of 40 undergraduates all have different experiences, and it is hard to talk about a concept and link it to all 40 experiences.

Ideally, we'd like to be present when all of our students are working with kids in the classroom, but that is not possible. The videodisc allows us to quickly introduce video examples as a context to anchor this knowledge.

For example, we might be explaining a concept in subtraction. It is not always easy to explain how elementary students develop conceptions and misconceptions about subtraction. We have pulled together a collection of video teaching segments to create videodiscs. In the case of the subtraction lesson, we have created a videodisc that is filled with good examples about how concepts and misconceptions are developed in mathematics. We use this videodisc in our lectures to provide contextualized environments. We show undergraduates how these misconceptions can occur and what they can do in order to remediate these problems. It's a valuable tool because through these video clips we have a shared experience, and it makes my teaching much easier than when I'm guessing about their experiences. The beauty of the videodisc is that I can get to individual clips very quickly.

We use a Macintosh SE and a Pioneer 4200 disc player. We use an LCD projection panel on an overhead to project the Mac screen. In my classroom last year, there were two 25-inch color monitors mounted. I simply plugged the videodisc directly into the jack in the wall, and I was ready to project the video. It took me just a few minutes to set up before class because I kept the videodisc player and the computer in a closet in the room. I just wheeled it out, plugged in the equipment, and it was ready to go.

We use *LectureMate*, a software program created at Vanderbilt, to cue the videodisc. *LectureMate* is simply a hypercard shell that allows you to create electronic overheads and control the videodisc.

When we make these videodiscs, we produce what we call scratch discs or glass discs. You only get one copy. They're relatively inexpensive to produce. For our lecturing, having only one copy is not a problem. We sort through the videotape that we want, put it onto a 3/4-inch tape for our master, and send that off to Crawford Communications in Atlanta. There are a number of sites around the country; however, we use Crawford because they're so close, and we get turnaround in about 24 hours. We pay approximately $300 for our scratch disc, but we do a lot of preparation in our own lab—we put down the time code, do the color balancing, and a lot of other things that a lab would charge for.

Class Management

I also used hypermedia last year in my class for some class management details. Because I had 40 students in one class, I knew it would take me an entire semester to learn their names if I didn't do something about it. So I decided to use a video camera. At the end of the first class, I set up the video camera in front of the class and said, "Before you leave today I want you to walk by, stand in front of the video camera, state your name, address, phone number, major, etc." So they did.

I took those video images and played them through a digitizing system and digitized each of their pictures and created my own class roster. When I clicked on a student's name, the student's picture appeared, so I was able to start connecting their names with their pictures. I hooked their phone numbers up with a dialing button. If I want to call them and say, "Hey, why aren't you coming to class?" I just click on that button and it goes through my modem. It calls them up and I can say, "Hey, start coming to class."

I also hooked the video to a grade book. I already had a hypercard grade book so it was easy to jump into the grade book and keep track of their grades, with that extra cue of the video image. I used this system, and it was great. Within a week I knew everyone's name and face. During the second class, I started to call on students by name. It shocked them, and they knew they had to pay attention. It worked out quite well.

TRAINER-RECOMMENDED SOFTWARE PRODUCTS AND TRAINING RESOURCES

Software Products

The following software materials were recommended by the experienced trainers who attended the National Forum for Technology Trainers in June 1990, a meeting sponsored by the Center for Special Education Technology.

Word Processing

Appleworks
Claris Corporation
Box 526
Santa Clara, CA 95052
408/727-8227; 800/628-2100

Microsoft Word
Microsoft Corporation
P.O. Box 97017
Redmond, WA 98073-9717
800/426-9400, 206/828-8080

QWERTY Word Processor
HFK Software
68 Wells Road
Lincoln, MA 01773
617/259-0059

Word Perfect
Word Perfect Corporation
1555 North Technology Way
Orem, UT 84057
801/225-5000

Desktop Publishing

Aldus Pagemaker
Aldus Corporation
411 First Avenue South
Seattle, WA 98104
206/622-5500

Xerox Ventura Publisher
Ventura Software, Inc.
15175 Innovation Drive
San Diego, CA 92128
800/822-8221

Authoring Software

Authorware Professional
Authorware
8500 Normandale Lake Road
Suite 1050
Bloomington, MN 55937
612/921-8555

HyperCard
Claris Corporation
Box 526
Santa Clara, CA 95052
408/727-8227; 800/628-2100

Hyperscreen
Scholastic, Inc.
2931 East McCarty Street
P.O. Box 7502
Jefferson City, MO 65102
800/541-5513

HyperStudio
Roger Wagner Publishing Inc
1050 Pioneer Way, Suite P
El Cajon, CA 92020
619/442-0524

Interactive Video Design Tool Kit
Electronic Vision, Inc.
28 Station Street
Athens, OH 45701
614/592-2433

Tutor-Tech
Techware, Inc.
P.O. Box 151085
Altamonte Springs, FL 32715-1085
407/695-9000

Presentation Software

Aldus Persuasion
Aldus Corporation
411 First Avenue South
Seattle, WA 98104
206/622-5500

Cricket Presents
Cricket Software
40 Valley Stream Highway
Malvern, PA 19355
215/251-9890
800/531-5236

Draw Applause
Ashton-Tate Corporation
20101 Hamilton Avenue
Torrence, CA 90502-1319
213/329-8000

Grandview
Symantec Corporation
10201 Torre Avenue
Cupertino, CA 95014
408/253-9600, 800/441-7234

LectureMate
Charity Ware
Learning Technology Center
Peabody College
Vanderbilt University
Box 328 PCVU
Nashville, TN 37203
615/322-8186

MORE
Symantec Corporation
10201 Torre Avenue
Cupertino, CA 95014
408/253-9600, 800/441-7234

Powerpoint
Microsoft Corporation
P.O. Box 97017
Redmond, WA 98073-9717
206/828-8080, 800/426-9400

Graphics

Canvas
Deneba Software
7855 NW 12th Street
Suite 202
Miami, FL 33126
800/6CANVAS

Harvard Graphics
Software Publishing Corporation
P.O. Box 7210
1901 Landings Drive
Mountain View, CA 94039-7210
415/962-8910

MacDraw
Claris Corporation
Box 526
Santa Clara, CA 95052
800/628-2100

MacPaint
Claris Corporation
Box 526
Santa Clara, CA 95052
800/628-2100

Design Resources

The following periodicals and professional associations focus on training materials, design issues, and topics.

Periodicals

The Computing Teacher
International Society for Technology in Education
University of Oregon
1787 Agate Street
Eugene, OR 97403-9905
503/346-4414

Instructional Delivery Systems
Interactive Instruction Development
50 Culpepper Street
Warrenton, VA 22186
703/347-0055

Journal of Computer-Based Instruction
ADCIS
220 Ramseyer Hall
29 West Woodruff Avenue
Columbus, OH 43210-1177
614/292-4324

Publish! The How-To Magazine
P. C. W. Communications
501 Second Street
San Francisco, CA 94107
415/546-7722; 800/222-2990

TRAINING
Lakewood Publications
50 South Ninth Street
Minneapolis, MN 55402
612/333-0471

The Videodisc Compendium for Education and Training/UPdate
Emerging Technology Consultants
P.O. Box 12444
St. Paul, MN 55112
612/639-3973

The Videodisc Monitor
P.O. Box 26
Falls Church, VA 22046-9990
703/241-1799

Professional Associations

Association for the Development of Computer-Based Instructional Systems (ADCIS)
229 Ramseyer Hall
29 West Woodruff Avenue
Columbus, OH 43210-1177
614/292-4324

Association for Educational Communications & Technology (AECT)
1025 Vermont Street, N.W., Suite 820
Washington, DC 20005
202/347-7834

International Communications Industry Association (ICIA)
3150 Spring Street
Fairfax, VA 22031
703/273-7200

International Society for Technology in Education (ISTE)
University of Oregon
1787 Agate Street
Eugene, OR 94703-9905
503/346-4414

Interactive Video Industry Association (IVIA)
800 K Street, N.W.
Washington, DC 20036
202/408-1000

Society for Applied Learning Technology (SALT)
50 Culpepper Street
Warrenton, VA 22186
703/347-0055

Technology and Media Division (TAM-CEC)
The Council for Exceptional Children
1920 Association Drive
Reston, VA 22091
703/620-3660