# A COMPARISON OF THE OUTCOMES OF INSTRUCTOR LED AND INTERACTIVE VIDEO DISK BASED ENERGY CONTROL AND POWER LOCKOUT AUTOMOTIVE TRAINING PROGRAMS

by

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DISSERTATION

Submitted to the Graduate School

of Wayne State University

Detroit, Michigan

in partial fulfillment of the requirements

for the degree of

DOCTOR OF PHILOSOPHY

2002

MAJOR: INSTRUCTIONAL TECHNOLOGY

Approved by:

Advisor Date

Co-Advisor

Dedicated

To

my Mother

and the everlasting memory of my Father

ACKNOLEDGEMENTS

Many people have directly and indirectly played roles in making this effort possible. I would like to acknowledge:

- Drs. Rita C. Richey & Donald R. Marcotte

  Co Advisors from Departments of Instructional Technology and Educational Evaluation & Research for their kindness, patience and guidance. They disciplined me in the areas of their expertise to the extent of my capabilities. I had the unique opportunity to work for both on their special projects and came very close to them gaining some of their insights in handling research problems.
- Dr. James L. Moseley, my dissertation committee member and professor of rare abilities and a kind heart. I marvel his memory; and am thankful to him for going through my manuscript word by word and offering me valuable suggestions.
- Dr. Edward J. Kerfoot from the Department of Occupational and Environmental Health, Applebaum School of Pharmacy and Allied Health Profession. He has been very kind and encouraging to me.
- Dr. Mary Jane Heaney, a great friend and a fellow researcher for continued encouragement to complete my dissertation. I cannot thank her enough.

  I am also very much thankful to Sylvia, Mary Jane's mother for being very kind to me and helped me in every way she could.

- I am very much thankful to my boss Mr. Thomas Wilhelm, Director of Testing Evaluation and Research Service for his continued support and encouragement over the years to finish my studies.
- Elaine Hockman, my mentor and former boss, Coordinator of Research Support Laboratory, Wayne State University, for teaching me the tricks of the trade, when I worked for her as a Research Consultant.
- I am thankful to Ms. June Cline for complete support when I was about to become one of the casualties of the Ph.D. program.
- I am very much thankful to Dr. Paula Wood, Dean College of Education, Wayne State University, for her continued encouragement over the years.
- My uncle and aunt Dr. and Mrs. Ansari for supporting me and providing me the opportunity to come to the United States.
- Last but not the least Annie my wife, and our children, Maria, Muneeb and Yosef for silently suffering through the unusually long period of my education that deprived them of many things in life, one can imagine.

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# Chapter 1

## Statement of the Problem

## And Review of the Literature

Competition is the basic element to keep businesses/industry in or out of market. In recent years the pressure has increased tremendously because of technological advancement and rapid application in industry. Toffler (1985) asserted that many changes were taking place in technology, even abruptly destroying the present while simultaneously creating the future. Heathman and Kleiner (1991), stressing the need of training, pointed out in today's world the pace of change is relentless. To keep up with it, to compete in their industries, and provide high-quality customer service, companies must train employees effectively while minimizing their time away from the job.

Health and safety training is one of the many types of training programs the major auto company offers to its employees. One such program is sponsored by a joint union-management training committee on Energy Control and Power Lockout (ECPL). Most training programs at this company had used the traditional instructor-led style, but then shifted toward use of computer technology. The second ECPL training program began with the use of Interactive Video Disk (IVD) technology. The question was if there were any significant differences in the training outcomes of knowledge, attitude toward training, and on-the-job behavior between the groups that had different types of delivery for instruction during their training.

Training is the teaching of a particular skill or a trade for a specific purpose. It can be considered as a subset of a broader term "Education", which is the development of overall personality in the social, intellectual and physical context. In non-academic arenas

such as in the corporate environment, training is gradually acquiring a much broader meaning. Usually the purpose of training is to promote employee learning of job-related skills, knowledge, and attitudes, and increase employees' worth or serviceability to the company, as well as to themselves. Industrial training programs also are designed for organizational improvement by improving employees' skills and attitudes. With rapid changes in technology, many companies have begun to recognize the importance of training and re-training of personnel.

The U.S. Bureau of Labor Statistics predicted that by 1990 U.S. industries that do substantial training would have grown faster than organizations not providing employee training. New laws now require employees to be properly trained. Company training needs are expected to continue to expand rapidly, as they have over the last few decades (Eurich, 1990).

Whether a company is going through restructuring or reengineering, reorganization, expansion, or even keeping up with competition or technology, training or retraining of personnel have become essential. Cost is one of the main considerations when training is needed. Companies prefer cost-effective training and try to develop programs, which cost less while maintaining an acceptable degree of effectiveness or have greater effectiveness for an acceptable amount of cost. Instructor-led training is still popular, but newer programs tend to include the computer-based training.

Generally, training programs are sponsored to improve employees' knowledge of safety and health, upgrade employees' skills, to assist displaced workers, and to facilitate promotion from within the company. In workplaces across the country, dramatic innovations are occurring in the fields of training and personal development. Joint labor-

management training programs are examples of innovations in training. While not all joint training programs have been equally successful, some, such as the early programs in the automobile industry, have been so bold and imaginative as to suggest that joint training programs could irreversibly change the contours of industrial relations (Hoyman,et. al. 1991).

This study compared outcomes of two technical safety-training programs that were delivered at a major auto company. Training was provided to employees involved in energy control and power lockout (ECPL) procedures. The first ECPL training program was presented in a lecture, videotape discussion format. The second used the interactive videodisc with the facility to avail the help of personnel who knew both the functioning of the Interactive Video Disc (IVD) and the subject matter. This training was enforced by a national joint union-company health and safety committee based on analysis of the company's accident records. These accidents resulted in serious injuries and even deaths. Repair to equipment was completed without locking out the sources of energy for equipment being repaired. The joint union-company health and safety committee funded the training programs.

Corporation or industry-based training programs have used instructor-led styles. As new technology was introduced into the design and delivery of training, new avenues became available, challenging instructional designers and recipients of training. The first ECPL training program was presented in an integrated lecture, videotape, and discussion format. This format combined the best of several methodologies- lecture for human element, technology for visual reinforcement in the subject matter, and discussion to respond to individual needs. Eurich (1990) says, "Experiments with tutored video

instructions show that students learn best when they stop the videotaped lecture frequently. It is most effective when students and a tutor watch together; it is less effective for a single student - with or without a tutor" (p. 9).

## Technology in Education and Training

### Computer-Based Training

With the advancement of technology and rapid proliferation of personal computers into society, the mode of delivery of instruction had to change. The greatest concern was over the elimination of human factors (the instructor). Technology-based training now includes computers, interactive videodisks, floppy diskettes, CD Roms, or a combination of media. The instructional material was presented by expert instructional designers working in collaboration with the subject matter and graphic expert among others. The trainee had to be computer literate and learn to handle different elements of technology efficiently. Each craftsman involved in accomplishing technology-based instructional programs applied a tool or a set of tools to complete his or her duty. New equipment and software choices are available to an instructional designer. While information presented on each of the various types of technology are current at the time of writing, they can change within a very short time.

With the advent of personal computers, there has been a revolution in technology-based training. The primary factor was the cost of personal computers. The second factor was the rapid advancement in technology to produce peripherals at lower costs with more power. The minimum of specifications in an IBM/Macintosh computer needed to produce an average-size technology-based training program is presented in Figure 1.

Figure 1

Minimum Requirements of a Technology Based
Training Development Computer

| Feature | PC | Macintosh |
|---|---|---|
| Processor | Pentium II – 200 MHZ | Mac G3 – 200 MHZ |
| RAM | 64 MB | 64 MB |
| Operating System | Windows 98 or NT | Mac OS 8 |
| Media Card | 4 MB video; 16-bit sound | Built in |
| Drives | 24 speed CD-ROM | 24 speed CD-ROM |
| Monitor | 17" high resolution | 17" high resolution |
| Accessories | Speakers, mouse keyboard, etc. | Speakers mouse keyboard, etc. |
| Price Range | $1,100 – $2,200 | $2,000 to $3,000 |

In addition to these computers, peripherals not tied to one user are necessary. The two most notable are at least an eight-speed CD burner (the low end of which can now be purchased for $600) and a color scanner (from $200 to $400) (Kevin & Keil, 2000, p31).

A wide variety of software is available to graphic artists based on productivity needs and designer preferences. An overlap of products can be used to create multimedia and Web products, but specialized Web tools are required for optimal performance.

Equipment costs are not directly associated with instructional design, because most instructional design personnel can use common word processors with specific script templates. Design products (e.g., Designers Edge from Allen Communications, a step-by-step product for creating CBT scripts) exist and frequently are used at a relatively low cost.

The term *authoring system* commonly refers to both multimedia production applications in general and those intended specifically for the creation of training materials. Authorware, IconAuthor, Director and Toolbook are the most commonly used systems for creating training applications.

Interactive Video Disk (IVD)

The interactive Video Disk was a technology used in this study. It is a combination of two devices, a computer and a videodisc. The videodisk is a silver colored 12-inch disc and can store 54,000 video images and 60-minutes of high quality audio. With this large capacity, significant amounts of data can be stored. To present this wealth of information to the learner, level three videodisk programs use computer text and graphics that are added to the monitor screen with menus from which learners can select instruction that adjusts methods and materials to their own learning styles, ability levels, and pace of learning. Not only can individual learners use videodisk programs, but also small and large groups can take advantage of videodisk programs, allowing opportunities for joint discussion of examples presented before entering a group input. Video, audio, stills, and text resources are available as feedback (Carlson & Falk 90-91).

A typical Interactive Video system consists of seven components:

1. The microcomputer provides the system's intelligence. It can process learner's responses and initiate appropriate branching.
2. The laser optical disc player instantly retrieves information stored on the optical disc, according to the prepared computer program and as initiated by the learner.
3. The interface hardware allows the computer and the video player to

communicate directly with each other.

4. The monitor normally displays images for both the computer and video player either in a serial mode, switching between computer screens and video screens, or as an overlaid image, containing both computer and video elements.
5. User input devices such as keyboard, mouse, touch screen, light pen, or sound recognition devices are used to allow the user to interact with the system.
6. The computer program provides the heart of the system and guides the visual display in response to the user's input. Sophisticated programs require hours of planning and design. Authoring languages/systems are currently used for easily coding the computer logic and preparing graphic illustrations as well as text screen.
7. The Laser optical discs may be videodisc, CD-I or DVI. They can be played as stills, step still, slow, normal, or fast motion; they have two tracks of audio which can be played in a stereo or as two independent monaural tracks.

Generally in interactive video, a microcomputer is linked with a video player. Using this configuration, information on the computer and the video is controlled by the microcomputer to allow the system to react to the individual learner's needs. The computer determines what and when single frames or video segments will be viewed (i.e. remedial testing, or information).

In the past decade, rapid growth and development of laser optical disc technology has opened up new horizons for making IV as responsive and interactive as possible. Beginning with emergence of videodisks and extending to digitized Computer Disc-

Interactive (CD-I), and Digital Interactive Video (DVI) technologies, today's educators have the most advanced toolbox with which to design instruction.

Besides being either deductive or inductive, different approaches to designing interactive programs are based on different learning theories implicit in them. The tutorial takes differences among the learners into account and defines what learners should know about the subject area and how they should go about learning it. What remains is the fact that some learners may already understand parts of the content and can save time by taking a shorter path through available materials. Learning is connected with time management and the recognition that large bodies of knowledge should be acquired in 'customized ' portions rather than in invariable steps (Hansen, 1989).

Application of Interactive Videodisc in Education. Interactive video has become a valuable tool in education. Many interactive programs have been developed for use from kindergarten through university and have become embraced as a viable training tool for all levels of personnel in industries, banking, businesses and professions (e.g., engineering, medicine, etc.). In general, Interactive Video can be implemented in the educational environment in a variety of ways. These range from Total Learning Systems that assume the role of instructor to use as learning components that can become powerful tools in traditional learning environment (Chen, cited in Iuppa & Anderson,1990-91). With advances in technology and instructional design, reduced cost in hardware and software, access to large amounts of memory, interface devices, creative authoring languages and simulated systems, increased opportunities are available for better learning experiences.

Levels of Interactive Videodisc. Three levels of interactive videodisc are

available for instruction:

*Level 1*: In Level 1, the video is least interactive. The system consists of a video player that can access video segments randomly, contains a video monitor or TV, and a means of user selection, such as a remote control device or bar code reader, is usually present. In a Level 1 system, all information presented comes from the video source, and the user needs to operate basic controls of the videodisc or videotape player to access the information. The system is relatively less expensive.

*Level 2*: These systems, are completely videodisc-based and have the capability to provide limited question and answer interaction and branching. As in Level 1, all of the information is contained in the video source material; Level 2 videodiscs have both video information and the control program on them. Level 2 has been used in many training applications.

*Level 3*: Level 3 equipment uses an external computer that is interfaced with a videodisc or videotape player, making it very powerful. The video source is augmented by the computer's text and/or graphics and by its powers of interaction. Simple Level 3 systems may have a separate computer and video monitors with only a serial cable to connect the computer to the player. The most complex systems allow computer text and graphics to be overlaid on the video display and may include enhancements such as touch screens or mouse control. Level 3 systems are the most expensive because they include the cost of the computer.

The basic advantage of videotapes is the availability of quality videotape material, the capability of inexpensive, yet powerful, recording and editing equipment, and relative ease with which video materials can be produced. But, the linearity of tape makes

information access difficult, and tape wear can be a problem. Although some videotape players (e.g., NEC's PC-VCR) were designed for this type of use, videodisc-based systems best represent the full capabilities of interactive video (Lehman (p. 3)

According to Hansen (1989):

> Interactive video has quickly established itself as a unique instructional technology in many fields where textbook instruction is too abstract and first-hand experience is not feasible because it is too costly or dangerous. It is also a relatively inexpensive and, more importantly, instantaneous way of recording and reviewing events that previously had only been open to direct observation, which often was difficult to arrange. (p. 7)

Training that formerly relied on descriptions, role-play, and occasional observations in the field could use realistic demonstrations of critical skills on a daily basis. In computer-based training or computer-assisted instruction (CBT/CAI), the following points were considered important to judge the effectiveness of a particular module:

- Degree of interactivity,
- Individualization of Instruction,
- Amount of learner control,
- Feedback to learners, and
- Monitoring of student progress.

Videodisc and Optical Storage Technologies. Engineers at Minnesota Mining and Manufacturing (3M) Company produced the first videodisc that could record and play back quality images. In the 1970s, several videodisc formats were developed. One, the capacitance electronic disc (CED) format, was marketed by RCA as Selectavision, but because of financial losses, RCA stopped manufacturing of CED discs. Another, the video high density (VHD) system failed because the format was awkward for interactive

video applications. The third major format, laser videodiscs, survived and emerged as the format of choice for interactive video. Laser videodiscs are the oldest of a growing family of optical data storage media. These media are recorded and played back using lasers and is referred to as optical media. The same technology was applied to computer data storage resulting in the development of compact disk-read only memory (CD-ROM). A single CD-ROM can store 660 megabytes of data or roughly a quarter of a million pages of text. The three major forms of pre-recorded optical discs available – laser videodiscs, CD-audio, and CD-ROM – are fairly well standardized. They share a number of attributes that make them desirable as information storage media. The stored information can be rapidly accessed, they are durable, have exceptionally long life, and, they can be linked with computers. Compact disk interactive (CD-I) was an attempt to set a standard for multimedia CDs similar to the standard established when digital audio compact discs (CD-DA) were first released. An important development in optical storage was the creation of record able media formats and optical disc recorders.

Write Once Read Many (WORM) optical technology has been around about as long as pre-recorded optical storage technologies. Businesses have used it to create audit trails of documentation, because a WORM disc once "burned," that is recorded, cannot be altered. WORM videodisc recorders have been available for many years, but the cost hindered their wide spread use.

CD-ROM recorders, conversely, plummeted in price from initial costs in the tens of thousands of dollars to a few hundred dollars and became widely available. CD-R is the record able version of the CD-ROM standard. Because of rapidly falling prices of both drives and media, CD-R became a popular mass storage option even for casual

users. CD-RW is the record able/re-writ able format of CD-ROM. Today, a CD-RW drive, which can record on either CD-R or CD-RW media, as well as play back CD-ROMs and record able discs, in an inexpensive accessory for a personal computer.

The latest optical disc development is a medium called DVD, variously labeled digital video-disc or digital versatile disc. This medium is the same size as CD-ROM but with seven or more times the information storage capacity. DVD players and media are becoming common in the marketplace, but it will likely be several years before its full impact is felt. The first major application of DVD is playback of movies stored in MPEG-2 compressed video format on DVD discs. Unlike videotapes, DVD discs do not wear out, and the picture quality of DVD videos is superior to VHS videotape. Set-top DVD players that attach to a television set provide playback capability to home consumers. In the future, DVD video will almost certainly replace the laser videodisc as the video playback medium of choice for education and training. To date, however, little educational material has been released in DVD format.

DVD-ROM is the DVD format analogous to CD-ROM but with much more storage capacity. First generation DVD-ROM discs have seven times the storage capacity of CD-ROMs. So, entire sets of CD-ROM reference discs, such as Microsoft's Encarta Reference Suite, can fit onto a single disc. By using a two-layer data storage system and both sides of a disc, in the future DVD discs may hold up to 17 megabytes of information. DVD-ROM drives, which can play back CD-ROM as well as DVD-ROM discs, are now replacing CD-ROM drives in many computers. While first generation DVD-ROM drives could not read CD-R discs, that problem has been resolved. While DVD-ROM is expected to replace CD-ROM, the somewhat higher production costs for

DVD are expected to allow CD-ROMs to remain viable and commonplace for many years to come. Recordable formats of DVD are also in development. However, early DVD recorders are quite expensive compared to CD-R/CD-RW drives, and the industry has yet to standardize formats. As a result, it is expected to be a few years before DVD recording attains the level of acceptance of CD-R/CD-RW presently. In the future, however, it seems certain that DVD will become the optical medium of choice for interactive video and data storage applications.

Two basic formats of pre-recorded laser videodiscs are available: constant angular velocity (CAV) and constant linear velocity (CLV). CLV is essentially a long-play format. CLV videodiscs, used mainly for movies, can store up to one hour of video per 12" side. (Eight-inch videodiscs are also available, although they are much less common.) Although top-of-the-line videodisc players can now accurately locate and capture individual video frames on CLV videodiscs (by use of video capture circuitry) for display, most players cannot display a still picture from a CLV videodisc. The other format, CAV stores approximately 30 minutes of video per 12" side, but has the capacity to access any individual frame on the disc. Because of that advantage, the CAV laser videodisc is the dominant medium in interactive video applications in education and training. The CAV videodisc has a number of advantageous characteristics including:

- 30 minutes of video per side;
- 54,000 individual frames per side;
- Rapid, random access to any frame;
- Jitter-free still frames;
- Two audio channels;

- Durable construction;
- Long media life;
- Inexpensive duplication from a master disc;
- Still frame audio with advanced players;
- Two additional audio channels with advanced players; and
- Digital data storage with advanced players

Videodiscs are produced by, transferring visual information (35mm slides, videotape, film, etc.) onto a, specially prepared videotape. Generally, 1" commercial quality videotape is used. This videotape is then sent to a videodisc mastering facility, such as the ones operated by 3M Company and Pioneer, where the videodisc is mastered (at a cost today of about $1800 per CAV side). During the videodisc manufacturing process, the data from the master videotape is first transferred to a glass master disc using photo-like processes. Metal is applied to the glass master to create a metal "stamper" disc. The stamper is used to stamp out plastic replicas by a plastic injection molding process. A reflective coating of aluminum is applied to the plastic discs. The end result is a shiny, rainbow-reflecting disc containing the video information encoded as billions of microscopic pits. The finished disc is encased in a clear plastic, which makes it nearly indestructible. Multiple copies can be had for about $20 or less each. Although the price of mastering a videodisc may seem high, the major cost is in the video production. While one can put together a videodisc for under $10,000, it is not uncommon for commercial concerns to spend upwards of $100,000 per side in making a videodisc. That, and the still relatively small educational market, explains why individual educational videodiscs can cost as much as $600 or more. For budget minded developers, there are commercial

concerns that will produce a single videodisc from a master tape for only about $300. These "check" discs are produced using a high quality WORM recorder, and every disc produced has a cost of $300.

Computer-Based Interactive Video Systems. From an educational standpoint, most powerful interactive video systems are the level 3 systems, those that use a computer. A level 3 interactive video system joins the capabilities of the CAV videodisc to a computer. The computer through an interface device (usually just a standard serial port) controls the functions of the videodisc player. Of course, the computer brings to the system a host of desirable, instructional features. It can manage and manipulate large quantities of information, provide immediate feedback, actively involve the learner, motivate, individualize instruction, simulate both natural and artificial phenomena, and flexibly perform many other tasks. Computers, by themselves, are powerful tools for education. When combined with videodiscs, they become potent multimedia educational tools. The hardware in a level 3 system at a minimum consists of the computer, videodisc player, an interface device, and one or two video monitors. In a two-monitor system, one monitor is dedicated to the videodisc and the other to the computer. One of the first such systems to become popular involved an Apple Macintosh computer (with its monitor) running HyperCard software to control a videodisc player connected to a separate video monitor or TV. A similar system used IBM's Link-way software for MS-DOS. Other systems that can do the same thing feature software such as Asymetrix Tool book (Windows), Macromedia Director (Mac OS or Windows), or Roger Wagner's Hyper Studio (Mac OS or Windows). Many other authoring packages also support videodisc interfacing. With the addition of an overlay device, a single monitor system can be

created that allows the computer text and graphics to be overlaid on top of the video from the videodisc player. While expensive, such systems make maximum use of the computer-videodisc interplay.

Apple Macintosh audio-visual computers, those with built-in video circuits, support the creation of a single-monitor system through Apple's versatile QuickTime software. IBM formerly produced a plug-in adapter, the M-Motion Adapter/A that permitted video display on the computer monitor. This adapter was a successor to the IBM Info Window system; an early interactive video product that established standards of sorts for interactive video overlay systems. In an overlay system, computer text and graphics can accompany or be laid over the video, which appears in a window on the computer display. This versatile combination of video and computer provides powerful education and training capability.

Many different interactive video system configurations are possible. In the videodisc arena, Pioneer and Sony are the dominant manufacturers of players in the U.S. The Pioneer CLD-V2800 currently is popular with schools because of its relatively low price (under $1000) and its features. It can be accessed via a hand-held remote, bar code reader, or external interface. For computer control, it uses a standard RS-232 interface, relies on the same built-in command language used by other Pioneer players, and can generate its own text overlay. It is also capable of playing audio CDs. A two-monitor, level 3 system can quickly be built around the CLD-V2800 using a Macintosh or Windows PC. Along with hardware, computer-based interactive video systems require software. The video material itself, of course, is a form of software. In addition, there must be software that tells the computer how to communicate through the interface to

control the videodisc player. With a machine like the CLD-V2800, this can be fairly simple, because Pioneer players respond to simple two-letter mnemonic commands sent via the serial port. However, with more complex systems, special driver software may have to be installed to facilitate the process. In addition, if one wants to create interactive video lessons, some sort of authoring software is needed. With authoring software, one can create lessons that use existing videodisc material within a computer program. This has been dubbed "repurposing" because it involves using the video material in ways that may not have originally been envisioned. Programs like HyperStudio, HyperCard, Director, and Toolbook offer the most flexible authoring options for the price. To make the process even easier, several companies offer products that support the creation of interactive videodisc materials in popular authoring platforms. Videodiscovery sells a program called MediaMAX that supports HyperCard (and formerly Linkway). The Voyager Company produces a Video Stack for HyperCard. There are other similar, though less full-featured programs, free of charge to educators that permit basic control of Pioneer videodisc players through HyperCard and Linkway. Thus, there are many options available for integrating videodisc content into interactive computer programs.

Although most multimedia today is CD-ROM delivered, and DVD is the wave of the future, venerable videodiscs and interactive video systems continue to have advantages. A large number of high-quality educational videodiscs, with hours of motion video and thousands of still images, have been produced. Even without a computer, teachers can use these materials in the classroom in Level 1 mode taking advantage of the flexibility and ease-of-use of the videodisc. With a computer, compelling forms of multimedia can be produced with relative ease. And, unlike digital forms of multimedia,

which can place significant storage and processing demands on the computer, the information from a videodisc comes from an external source and so does not tax the computer system. One can still use an impressive level 3 interactive video with an older Macintosh or a PC.

Uses of Interactive Video. In 1994, it was estimated that the markets for interactive videodisc use broke down as follows:

- 31% Training
- 24% Point of purchase applications
- 17% Military and government use
- 10% Education
- 6% Medical
- 12% All others (Lehman, 2000)

Although percentages have probably shifted today, these categories remain important. Training in business and industry traditionally has been a major use of interactive video and multimedia. The military and government, while making use of videodisc's archiving capabilities, also has used interactive video extensively for training. Several years ago, the U.S. Army's Project Electronic Information Delivery System (EIDS) surpassed General Motor's interactive video network as the largest single interactive video project. Point of purchase (POP) applications, remain important in a number of venues. Interactive video has been used in many retail outlets, as well as in the real estate industry as a sales tool. Interactive video continues to be used for information dissemination in places like Walt Disney World's EPCOT Center and the St. Louis Zoo.

## Theoretical Aspects of the Issue

Controversy has been raised regarding merits of research comparing outcomes of different instructional methods and instructional media (Clark, 1983; Kozma 1994). Traditional media comparison research compared the new medium with teacher-led instruction. The typical focus of the research was determining if one medium was better at teaching subject matter than the other. Salomon and Clark (1977) cited Knowlton and Mielke and indicated this question was invalid leading to un interpretable results, if any results were obtained.

A review of literature revealed that leading researchers differed in their opinions of the veracity of video training. Proponents of interactive video training claimed that substantial learning advantages were found with respect to knowledge acquisition and reduction of instructional time (Brogan, cited in Branch et. al., 1989). Copeland (1988) supported the use of IVD in training programs and noted that experiments with interactive video used for training in the USA and UK have confirmed its effectiveness and that trainees enjoyed its use[1]. Nevertheless, findings of no difference between treatments are troubling to both instructional designers and researchers. Research evidence produced by Schramm (1977) claims that the instructional strategy, rather than the medium, influences the learning process. However the medium affects only interaction between learners and the medium. Clark (1994) emphasizes that media and their attributes have important influences on the cost or speed of learning, but only the use of adequate instructional methods influences learning acquired.

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[1] For purpose of references Appendix (C) lists the studies of significant differences and no significant differences in the form of Table from year 1928 to 1999.

Studies of the influence of media on learning have been a fixed feature of the educational research. (Thorndike cited in Clark, 1983) recommended pictures, as a labor saving device in instruction. Most of this research was buttressed by the hope that learning could be enhanced with the proper mix of medium, student, subject matter, content, and learning task. A typical study compared the relative achievement of groups who received similar subject matter using different media. This research led to 'media selection' schemes or models (Reiser & Gagne, 1982). However, Clark (1983) argued that most current summaries and meta-analyses of media comparison studies clearly suggested that media did not influence learning under any conditions. Even in the few cases where dramatic changes in achievement or ability followed introduction of a medium, as was the case with television in El Salvador (Schramm cited in Clark, 1983), most feel the medium did not cause the change but rather the curricular reform that accompanied the change.

According to Clark (1983), the best current evidence regarding the use of media in instruction is that media are "mere vehicles that deliver instruction, but do not influence student achievement any more than trucks that deliver groceries cause changes in nutrition"(p. 445). Basically, the choice of vehicle could influence the cost or extent of distributing instruction, but only the content of the vehicle can influence achievement (Clark, 1983). He then concluded and suggested that researchers should refrain from conducting additional studies that examine the relationship between media and learning unless they suggest the existence of a novel theory.

Kozma (1994) in responding to Clark's research, as well as other studies that

opposed "the no difference" point of view, stated that:

> . . . the capabilities of a particular medium, in conjunction with methods that take advantage of these capabilities, interact with and influence the ways learners represent and process information, and may result in more or different learning when one medium is compared to another for certain learners and tasks. (p. 14)

Copeland (1988) supported Kozma's supposition that

> . . . people learn more when they participate rather than when they are passive. If what is to be learned can be made personally relevant, then again learning is greater. If prompt and meaningful feedback is presented, then learning is more efficient and more effective. It was established that motivation and repetition assist learning and retention. (p. 61)

The media comparison study resulted from the Kozma-Copeland point of view. It successfully sought to determine if dissimilar media produce different learning results. However in the research referenced by Clark and Kozma, learners tended to be children, or if adults, they were typically from an academic environment. Learners in the present study are categorized as adult learners from an industrial work force. A paucity of literature is available in the area of adult learning and media comparison outcomes in an industrial setting. Literature available in industrial training and use of interactive video tended to have a commercial base.

Clark (1983), conversely claimed that "media research was a triumph of enthusiasm over substantive examination of structural processes in learning and instruction" (p. 457). Media and their attributes have been influential in regard to the cost

or speed of learning, but maintained that only the use of adequate instructional methods can influence learning. He defined instructional methods as the provision of cognitive processes or strategies that are necessary for learning but which students cannot or will not provide for themselves. So Clark asserted that absolutely any necessary teaching method could be delivered to students by any media or a variety of mixtures of media attributes with similar learning results. He further argued that media were mere vehicles for instructional delivery, but had little or no impact on student achievement. Basically, the choice of vehicle might influence the cost or extent of distributing instruction, but only the content of the vehicle can influence achievement Clark (1983).

Instructional methods had been confounded with media and that instructional methods and not the medium that influence learning. Certain attributes of media can be modeled by learners and shape the development of unique "cognitive processes" (Salomon cited in Clark,1994).

According to Clark (1994), a number of very different media attributes served the same or similar cognitive functions. Since no single media attribute serves a unique cognitive effect for a learning task, then attributes must be proxies for other variables that may be instrumental in learning gains.

An instructional method is any way to shape information that activates, supplants or compensates for cognitive processes necessary for achievement or motivation. Instructional or training design technologies draw on psychological and socio-psychological research to select necessary information and objectives and design instructional methods and environments that enhance achievement.

A different technology - delivery technology - is necessary to provide efficient

and timely access to those methods and environments (Clark, 1994). Both technologies make vital but different contributions to education. Delivery technologies influence the cost and access of instruction, while design technologies make it possible to influence student achievement. Media not only fail to influence learning, but are not directly responsible for motivating learning. The concluding opinion is that a long history of a basic confusion between these two technologies exists that confounds the study of contributions of media. Whenever learning occurs, some medium or mix of media must be present to deliver instruction. Clark and Kozma's opinions are compared in Figure 2.

Figure 2

Comparison of Clark and Kozma's Views

| Clark's position | Kozma's position |
|---|---|
| 1. Most current summaries and meta-analyses of media comparison studies clearly suggest that media do not influence learning under any conditions. Hence researchers should refrain from producing additional studies exploring the relationship between media and learning unless a novel theory is suggested. | 1. There is no compelling evidence in the past seventy years of published and unpublished research that media cause learning increases under any conditions". Kozma then suggests to reformat the argument about future possibilities of media as causal agents in learning. |
| 2. Instructional methods had been confounded with media and that it is methods, which influence learning. | 2. Whenever learning occurs, some medium or mix of medium must be present to deliver instruction. |
| 3. When a study demonstrates that media attributes are sufficient to cause learning, the study has failed to control for instructional method and is therefore confounded. It is true that in some cases instructional treatments containing media attributes are sufficient to cause learning. When this happens, the necessary conditions to cause learning are embedded in the sufficient treatment . We know that the active ingredient in successful media treatments is not media attributes because in all known attempts to replicate these studies, different attributes produce similar learning results - provided that the required instructional method is present in the compared versions of the media attributes. | 3. Media attributes are not "necessary" variables in learning studies, whereas "sufficient conditions" are important to a design science. Scientists concerned with necessary conditions are those interested in eliminating something undesirable, such as disease....On the other hand, scientists interested in the production of something desirable, such as learning, are concerned with establishing conditions that are sufficient to bring it about....Necessary conditions are those in whose absence an event cannot occur, while sufficient conditions are those in whose presence an event must occur. |

## The ECPL Training Program

### Historical Perspective of the ECPL Training Program

Based on Geller's 1986 research for the Motor Vehicles Manufacturers Association and an analysis of company accident records, the auto company's National Joint Committee on Health and Safety (NJCHS) sponsored a joint UAW and auto company's health and safety training program on Energy Control and Power Lockout (ECPL). This training program educated the auto worker in Energy Control and Power Lockout procedures for primary and secondary energy sources (i.e., electrical, pneumatic, hydraulic, gas, steam, chemical, mechanical motion, gravity, stored mechanical energy, thermal energy.). The second training program, which began in May 1990, included plants from Livonia, Michigan and four plants from Ohio. Both programs were designed and developed by external vendors.

### First ECPL training program

The first ECPL training program was conducted in 1989 company-wide. This program used the instructor-led approach to provide the training.

Program development. A needs analysis was completed to determine skills, knowledge, and attitudes relating to Electronic Control and Power Lockout (ECPL). The following methodology was adopted. In March 1986, at the UAW Sub-Council meeting in Atlanta, 100 skilled trades workers were surveyed regarding knowledge, skills and attitudes of ECPL. An additional 100 interviews were conducted in six auto manufacturing company plants. Employees who were interviewed included: skilled tradesmen, apprentices, job setters, cleaners, union health and safety representatives, UAW local presidents and chairmen, industrial relations manager, supervisors and

company safety engineers. Seventy-one ECPL-related accidents occurring between 1980 and 1986 were analyzed to determine if patterns could be discerned that should be included in the training programs. A review of current ECPL training programs being piloted at the company facilities and ECPL programs produced by private vendors was conducted to determine the efficacy of these programs in adequately training employees.

An analysis was completed on work done by the Employee Health Services Department of the auto company and the UAW Health and Safety Department. Instructional designers worked with subject matter experts and skilled representatives of the work force to be trained to determine training needs. The initial program design was submitted to the ECPL advisory board consisting of experts in health and safety from union and the company for examination. Revisions were made based on recommendations from the advisory board. A group of 15 subject matter experts (SMEs), formed by the UAW and auto company's National Joint Committee on Health and Safety (NJCHS), provided technical input throughout the program's development. After revising the program design on recommendations of the SMEs, validity of the design was tested in five plant sites. The final program design was completed after receiving input from hourly and salaried workers from six additional plants that participated in the pilot project. The instructional material included:

- eight (8) modules,
- video tapes,
- instructor's manual,
- participant workbook, and
- pocket manuals.

Seven of the eight modules focused on behavioral change and skill development, with the eighth module developed for local plant and union leadership. The first of the eight modules was directed toward leadership commitment for local plant and union management. The remaining seven modules were aimed at the employees who are expected to follow lockout procedures on their jobs. These modules were concerned with behavior change and skill development. The seven participant modules included the following:

- Believe it
- Check it
- Prep it
- Lock it
- Release it
- Verify it
- Use it

Classes were conducted at various auto-manufacturing plants using the following protocol:

- Nonprofessional trainers presented the program content, demonstrated the ECPL procedures, and led the discussion.
- Seven 2-hour training sessions were given to groups of less than 25 participants.
- Each of the seven modules were designed to be delivered in one classroom session.

- The course was designed to be delivered to small groups of approximately 16 employees.
- The classroom sessions were informal, interesting, and active. ( They involved the participants in using all the course components, such as the Videotape and the Lockout manual. The Videotape included 20-25 minutes of full-motion picture, which could be paused at relevant places to allow for active discussion.)

Courses were repeated in each plant until all participating personnel had attended. Trainers included both salaried/hourly employees whose duties included either lockout or supervision of employees who needed to lockout. The trainers received four days of training to prepare them to serve as instructors.

Second ECPL training program (IVD based)

The second ECPL training program began in May 1990 using the *same instructional material* as the first ECPL training program, but the delivery system was changed to incorporate self-instructional and self-paced modules using Interactive Video Disc (IVD) technology.

Course overview. The course content was composed of seven single-sided video discs with still frames and audio, participant manual, course administrator guide, and student diskette. A Zenith Level III, IVD system with a Pioneer video disc player, a keyboard, and touch screen were used in this program.

Seven participant modules used in this training course used the same titles as the first training program and had the same course content. The course was authored in Authority 5.1, which runs on the PC-based computer, using "Windows" as the operating

system. The system has record-keeping facilities (e.g., score reports for both pre and post-test results, percentage of right responses and number of attempts, shows a list of competencies a student has achieved in the course). The system records time and number of log-ins etc. Each module requires approximately 45 to 60 minutes to complete.

The first time user necessarily goes through the modules, lessons, topics and sub-topics in strict order. For example, the first lesson must be completed prior to starting the second module. At the end of each section, the appropriate menu (i.e., course, module, lesson and topic) was checked for completion. The learner could interpret motion segments to see some of the following options that moved him/her through the lesson. When s/he completed a module or lesson, the learner could browse that portion of the course at will.

Essentially the same instruments were used to collect pre- and posttest the training participants. Additional items were added to determine participants' attitudes of using the IVD instructional delivery method. The participants took approximately 20 minutes to complete the questionnaire.

The ECPL Training Program Research

ECPL Research. Lick's (1989) research was "The Effects of Organizational and Environmental Climate Factors on a Joint Union-Management Safety Training Program at a U.S. Automaker." He used pre and post-test data from participants of an Energy Control and Power Lockout (ECPL) instructor-led training program conducted in 1989 at a major automobile company. Brogan (1992) replicated Lick's study by collecting data from the participants of the second ECPL IVD-based training program, which used the same material and coursework for her doctoral dissertation. It was titled "The Effects of

Organizational and Learning Climate and Changes in Perceptions of Environment on Learner's Knowledge, Attitude, and Behavior After Participation in an Interactive Video Safety Training Program."

Purposes of the Two Studies. The purpose of Lick's (1989) study was to identify organizational and environmental variables that influenced success or failure of the Energy Control and Power Lockout program at the Automotive Company. His research sought to determine factors that affected the success of the training program, as measured by knowledge gained by participants. These factors included:

1. Physical factors in the training environment (i.e., noise, ventilation, lighting, class size, room size, seating configuration, and training aids).
2. Environmental attitude factors relating to management's and the immediate supervisor's commitment to health, safety, and ECPL.
3. Organizational factors such as management style, working conditions, job satisfaction, teamwork, and commitment to quality.
4. Trainee and trainer demographic characteristics.

Brogan (1992) examined the effects of organizational climate, interactive videodisc climate, and situational learning environment variables on knowledge, attitude, and behavior after completion of the ECPL safety training program. She investigated the following four research questions.

1. What is the relationship between organizational climate and learners' knowledge gain, attitude change, and on-the-job behavior?

2. What is the relationship between the interactive video learning climate and learners' knowledge gain, attitude change, and on-the-job behavior?

3. What is the relationship between changes in the learners' perceptions of the situational learning environment from the start to the end of the training and the learners' knowledge gain, attitude change, and on-the- job behavior?

4. Did significant changes occur in learners' attitudes toward the situational learning environment from the start to the middle to the end of the training?

The present study used the existing databases of the Lick (1989) and Brogan (1992) studies to compare *relative achievement* of the groups of workers who participated in the ECPL training program, which used the *instructor-led approach* and the groups of workers who participated in the second ECPL training program that used the *interactive video disk approach* in a nontraditional setting.

Purpose of the Study

Training has been provided in a large manufacturing company using two types of instructional delivery methods, instructor-led and interactive video disk (IVD). The purpose of this study was to examine differences in knowledge, behavior, and attitude toward training between employees who participated in the instructor-led training and those who used IVD to obtain the training instruction.

The following research questions were posed for this study:

1. What is the difference in trainee composite ECPL knowledge retention of processes as a function of type of program (Lecture/Video or IVD)?
2. What is the difference between trainee attitudes toward safety as a function of type of program (Lecture/Video or IVD)?
3. What is the difference between trainee perceptions of management attitudes toward safety as a function of type of program (Lecture/Video or IVD)? Management attitudes toward safety will be interpreted in terms of:

   a: Perceptions of organizational lockout behavior; and

   b: Perceptions of general management attitudes toward safety.
4. What is the difference between trainee performance as a function of type of program (Lecture/Video or IVD)? Trainee performance will be interpreted in terms of:

   a: Post-training lockout performance; and

   b: Failure to follow lockout procedures.

Significance of the Study

Little literature is available in industrial training that compares the outcomes of lecture based delivery and technology based delivery methods, the available literature has a commercial base reducing its validity to be used as a reference. This research could be a significant contribution not only in the area of health and safety training, but for other forms of training that are being conducted in industrial settings for a few of following reasons:

- Industrial environment is not a typical classroom setting.

- Participants in the training program were older adult learners in a non-traditional setting.
- The outcomes of ECPL training program could be generalized to the participants of the other technical training programs needed to update the skills of workers to use new technology needed to keep American industry competitive.
- The growth over the microcomputer based, i.e., CAI, IVD etc., has culminated so far to web based interactive designs for instruction. This research will open new vistas for instructional design.

Definition of Terms

The following terms are defined specifically for this study:

| | |
|---|---|
| Audiovisual Technologies | Ways to produce or deliver materials by using mechanical or electronic machines to present audio or visual imagery.( Seels & Richey, 1994). |
| Authoring | Using an authoring language or system to design and develop instruction. (Seels & Richey, 1994). |
| Authoring Language | A computer language, which is specifically designed for developing computer-assisted instruction (and which) requires (the user to have) some knowledge of computer programming (Schwier, cited by Seels & Richey, 1994). |
| Authoring system | A computer program that is designed for computer-assisted instruction development. Procedures are predefined and require little or no programming knowledge on the part of the user. (Schwier, cited by Seels, 1994). |
| CD-ROM | A high-capacity, optical storage medium (Parsons, et al., 1999). |
| Computer-Based Technologies | Ways to produce or deliver materials using microprocessor-based resources. (Seels & Richey, 1994) |

| | |
|---|---|
| Delivery System - | The method ( a combination of media and support systems) by which distribution of instructional materials is organized and employed to present instructional information to a learner (Ellington & Harris, cited in Seels & Richey, 1994). |
| Design | The process of specifying conditions for learning, also a domain in the field of Instructional Technology (Seels & Richey, 1994). |
| Front End Analysis | Accomplishment of the early stages of the design process, such as analysis of needs, goals, and objectives, and organizing the course units. (Briggs, cited in Seels & Richey, 1994). |
| Restructuring | An ongoing process within an organization, that requires time and commitment to rejuvenate technologies, redesign products and reshape markets (Rock & Rock, 1990). |
| Re-engineering | An approach to planning and controlling change. Business re-engineering means redesigning business processes and then implementing the new processes (Morris & Brandon, 1993). |
| Write once, Read many (WORM) | Any type of storage medium to which data can be written to only a single time, but can be read from any number of times (Parsons, et al., 1999). |

## Limitations of the Study

The following limitations were acknowledged for this study.

1. The study was completed in one automobile manufacturing company. As a result the findings may not be generalized to other manufacturing organizations that provide training to their employees.
2. The study involved only one training program, albeit offered using two different instructional delivery methods. Other training programs may not have similar results depending on the focus of the instruction.

3. Unequal sample sizes for the groups (75.7% for participants in the instructor-led training group and 24.3% in the IVD group) may have affected the outcomes of the study.
4. Sources of participants in the first study were from five plants with 15 training coordinators. These participants were selected from more than 5.000 employees who participated in this training. The second group of participants was drawn from a smaller population, which could result in a difference between samples.
5. The lack of researcher control over methods used to collect the original data is also a limitation of the study. The researcher must depend on the information provided in the original researchers' reports that the data were collected in an ethical manner.

# Chapter 2

## Methodology

The methods that were used in this study to collect and analyze the data needed to address the research questions are described in this chapter. Topics included are the research design, sources of data, participants, and data analysis. The study is based upon a secondary analysis of previously collected data.

### Research Design

An ex post facto research design using a secondary analysis of previously collected data was used in this study. This type of research design is appropriate when examining these data for findings beyond the original studies for which the data were collected.

### Population and Sample

This study is based on the data sets collected to evaluate each of the two ECPL programs. The samples of these data sets are described below. The trainee population for the first ECPL evaluation consisted of hourly and salaried employees at all company plants that were responsible for energy control and power lockout at a major auto company.

Sample 1. The sample for the first ECPL training program was drawn from employees at five different plants in the metropolitan Detroit area. A total of 5,332 persons working in these five plants were trained in ECPL by 15 training coordinators who were assigned to these plants.

A sample of 284 employees including 221 (77.8%) hourly, and 63 (22.2%)

salaried employees, completed both the pre-test and post-test measures and were included in the sample. Two additional employees completed both the pre-test and post-test, but did not indicate their employment status. Table 1 presents the employees by employment status and departments.

Table 1

Locations and Employees Participated in the First ECPL Training Program

| | Type of Employee | | | | Total | |
|---|---|---|---|---|---|---|
| | Hourly | | Salaried | | | |
| Plant | Number | Percent | Number | Percent | Number | Percent |
| Assembly | 31 | 14.0 | 20 | 31.7 | 51 | 18.0 |
| Parts Mfg | 46 | 20.8 | 8 | 12.7 | 54 | 19.0 |
| Plastics | 24 | 10.9 | 6 | 9.5 | 30 | 10.6 |
| Stamping | 24 | 10.9 | 8 | 12.7 | 32 | 11.3 |
| Transmission | 96 | 43.4 | 21 | 33.3 | 117 | 41.2 |
| Total | 221 | 100.0 | 63 | 100.0 | 284 | 100.0 |

These workers were participating in training classes at the times when the pre-test was administered. Hourly employees in the sample included machine operators, maintenance personnel, and skilled tradesmen. Supervisors of the hourly employees comprised the salaried employee group (Lick 1989). Because of administrative difficulties, such as scheduling and distribution, the sample could not be randomized in a traditional way. However, the following methodology was adopted:

- Since the training was conducted during the normal production hours, only a few employees could be spared for the training at a given time, the trainees

were taken from a large number of departments for each batch of trainees depending on their schedule.

- Employees who participated in the pre-test were selected to accommodate work schedules. In this way, randomization was approximated by default (Richey, 1989).

Sample 2. Trainees from two plants in Detroit and three plants from Ohio participated in this training program. Two of the five plants were engine assembly plants, a third was a transmission plant, the fourth was a plastics plant and the last one was a foundry. The trainees were employees who were either new to the company or who had not participated in previous training programs. Table 2 presents a description of the plants and number of participants in the second ECPL training program at each plant.

Table 2

Locations and Employees Participated in the Second ECPL Training Program

| | Type of Employee | | | | | |
|---|---|---|---|---|---|---|
| | Hourly | | Salaried | | Total | |
| Plant | Number | Percent | Number | Percent | Number | Percent |
| Transmission | 4 | 3.6 | 14 | 37.8 | 18 | 12.2 |
| Plastic Components | 6 | 5.5 | 0 | 0.0 | 6 | 4.1 |
| Iron Foundry | 7 | 6.4 | 10 | 27.0 | 17 | 11.6 |
| Engine Assembly I | 9 | 8.2 | 3 | 8.1 | 12 | 8.2 |
| Engine Assembly II | 84 | 76.4 | 10 | 27.0 | 94 | 63.9 |
| Total | 110 | 100.0 | 37 | 100.0 | 147 | 100.0 |

The trainees for the second ECPL training programs were selected on a stratified basis because of scheduling and distribution requirements. Hourly employees in this training program included, machine operators, maintenance personnel, and skilled tradesmen. The salaried personnel were supervisors for the hourly employees. A total of 147 employees completed the pre-test, with 92 participating in the post-testing. The 55 employees who did not complete the post-testing could not be identified to determine their plant locations.

Instrumentation

Data collection instruments for the first and second ECPL study included both quantitative and qualitative instruments; however, the present study utilized only the quantitative part because of the nature and purpose of this study. Among the data collection tools were:

- Pre and Post questionnaires;
- Follow-up telephone interview questionnaires;
- Follow-up Focus group questionnaires (used only in the first program) and
- Interviews with the trainers.

The pre and post-test questionnaires were identical and contained questions to measure employees' attitudes toward:

- The employing organization;
- The plant in which they are working;
- Communication within the plant;
- Perceived inherent safety risk of their jobs;

- Immediate supervision;
- Management commitment to health and safety; and
- Overall job satisfaction.

Attitudinal questions were developed in collaboration with industrial psychologists from the auto company personnel research department. These questions were similar to questions it had previously used in employee attitude surveys. Some attitudinal questions were adopted from the standardized attitude questions of the Mayflower Group. (It is general practice of most large companies to use these questions in their attitude surveys and share results.) The questions relating to perceived job risks were adopted from questions used by Geller (cited in Lick, 1989). The ECPL Hazard and Procedures Knowledge-based questions were developed from the ECPL workbook.

The questionnaire was reviewed and approved by the UAW and the auto company's National Joint Committee on Health and Safety (NJCHS). Two versions of the questionnaire were used during the data collection. The differences were in the wording to direct some questions to either salaried or hourly employees.

The questionnaire was peer reviewed and piloted at a plant representative of the sample of the study. The pilot group included salaried and hourly employees. They responded to the questionnaire and commented on it in a focus group setting. The questionnaire required approximately 20-30 minutes to complete. Based on the results of the pilot test, the questionnaire was modified.

The follow-up questionnaire (which was used for trainee interviews), the follow-up focus group interview questionnaire, and the trainer interview questionnaire were

developed by the Wayne State University research team, under the direction of Dr. Rita Richey (Lick 1989).

Factor Analysis

In order to present a meaningful organization of the attitudinal items, a factor analysis was done on the 20 attitudinal, items of the post-test survey, and a principal components factor analysis using a varimax rotation was employed. The results of the factor analysis are presented in Table 3.

Table 3

Factor Analysis
Attitudes Toward ECPL Training

| Item | Organizational Lockout Behavior | Post-training Lockout Perform-ance | Trainee Attitude toward safety | General Management Attitudes Toward Safety | Failure to follow lockout procedures |
|---|---|---|---|---|---|
| 5 | .75 | | | | |
| 4 | .69 | | | | |
| 9 | .67 | | | | |
| 1 | .60 | | | | |
| 12 | .59 | | | | |
| 3 | .43 | | | | |
| 18 | | .85 | | | |
| 13 | | .80 | | | |
| 14 | | .65 | | | |
| 6 | | | .76 | | |
| 2 | | | .63 | | |
| 8 | | | .54 | | |
| 16 | | | .40 | | |
| 20 | | | | .57 | |
| 7 | | | | .54 | |
| 10 | | | | .50 | |
| 21 | | | | .46 | |
| 15 | | | | -.41 | |
| 17 | | | | | .81 |
| 11 | | | | | .55 |
| Eigenvalue | 3.05 | 2.46 | 1.85 | 1.75 | 1.36 |
| Percent of explained variance | 15.25 | 12.32 | 9.24 | 8.76 | 6.78 |

Five factors, management attitude toward safety, performance, personal perceptions of safety, problems with safety lockout, and performance failures, emerged

from the factor analysis. The five factors explained a total of 52.33% of the variance in perceptions of ECPL training. The eigenvalues associated with each factor were greater than 1.00, which indicated that the factors were explaining a statistically significant amount of variance in the latent variable, perceptions of ECPL training.

One item on the fourth factor, problems with safety lockout had a negative loading on the factor analysis. Prior to summing the scale to obtain a score, this item was recoded to reflect the direction of the wording on the remaining items. As a result of the results of the factor analyses, these five factors were used as subscales in addressing the hypotheses developed for this study.

Data Collection (ECPL Training Program 1 and Training Program 2

An introductory letter was mailed to participants in the ECPL study from the UAW and auto company's National Joint Committee on Health and Safety. The purpose of this letter was to explain the importance of ECPL evaluation project and to indicate that Wayne State University was evaluating the program for the company.

Data collection for both the ECPL training programs took place through the use of pre and post-test identical questionnaires. Pre-tests were completed at least one month prior to the start of training programs and post-tests were conducted 30-120 days after the completion of training. The coordinators of both the training programs were trained to administer and collect questionnaires. Additionally, the coordinators of the ECPL/IVD program were trained in the use of IVD equipment at the joint union/auto company training center. These coordinators were trained to collect data, including administering pre and post training questionnaires as well as post-module questionnaires. One or more

members of the research team were from Wayne State University. Written directions were sent to all the coordinators to ensure that all data collection was completed in a consistent manner.

Data Analysis

The procedures used in this study included both descriptive and inferential statistical analyses to describe the sample and test the four questions developed for this study. The descriptive statistics included frequency distributions, crosstabulations, and measures of central tendency and dispersion to provide a profile of the participants in the study. A principal components factor analysis using a varimax rotation was used to determine if interpretable factors would emerge from the 20 attitudinal questions that could be used to organize the results of the study. The four questions were tested using inferential statistical procedures. These procedures included multivariate analysis of variance, and t-tests for two independent samples. An alpha level of .05 was used as the criterion for determining the statistical significance of the inferential tests. Figure 3 presents the statistical analyses that were used to test each of the questions.

Figure 3

Statistical Analyses

| Research Question | Variables | Statistical Procedure |
|---|---|---|
| Q 1:<br>What is the difference in trainee composite ECPL knowledge retention of processes as a function of type of program (Lecture/video or IVD)? | Dependent Variable<br>Trainee composite ECPL knowledge retention of processes.<br>Q (19, 22-43) Composite score of Post-test questionnaire.<br>Independent Variable<br>Type of training program<br>· Lecture<br>· IVD | t-Tests for two independent samples will be used to determine if there are differences in composite knowledge retention of processes between trainees who participated in a combined training program or a self-paced interactive video (IVD) modules. |
| Q 2:<br>What is the difference between trainee attitudes toward safety as a function of type of program (Lecture/video or IVD)? | Dependent Variable<br>Attitudes toward safety.<br>Q (6,2,8,16) Post-test questionnaire.<br>Independent Variables<br>Type of training program<br>· Lecture<br>· IVD | A multivariate analysis of variance (MANOVA) was used to determine if there was a difference in the subscales used to measure attitudes toward safety and type of training program. |
| Q 3:<br>What is the difference between trainee perceptions of management attitudes toward safety as a function of type of training program (Lect/video or IVD). Management attitudes toward safety will be interpreted in terms of :<br>a. Perceptions of organizational lockout behavior, and<br>b. Perceptions of general management attitudes toward safety. | Dependent Variable<br>Management attitudes toward safety.<br>a. Perceptions of organizational lockout behavior.<br>Q (1,3,4,5,9,12) Post-test questionnaire.<br>a. Perceptions of general management attitudes toward safety.<br>Q (7,10,15,20,21) Post-test questionnaire.<br>Independent Variable<br>Type of training program<br>· Lecture<br>· IVD | A multivariate analysis of variance (MANOVA) was used to determine if there was a difference in management attitude toward safety in terms of organizational lockout behavior and management attitude towards safety. |

| Research Question | Variables | Statistical Procedure |
|---|---|---|
| | | |
| Q 4: What is the difference between trainee performance as a function of type of program (lecture/video or IVD). Trainee performance will be interpreted in terms of :<br>a. Post-training lockout performance and<br>b. Failure to follow lockout procedures. | <u>Dependent Variables</u><br>· problems with safety lockout, Q(13,14,18) of post test questionnaire.<br>· failure to follow lockout procedures, Q(11,17) of post test questionnaire.<br><br><u>Independent Variables</u><br>Type of training program<br>· Lecture<br>· IVD | A multivariate analysis of variance (MANOVA) was used to determine if there was a difference in trainee attitude toward safety in terms of trainee lockout performance and failure to lockout procedures. |

# Chapter 3

## Results of Data Analysis

This chapter presents the results of the data analysis that were used to describe the sample and addresses the research questions posed for this study. This study used existing databases to compare the relative achievement of workers who participated in the Energy Control and Power Lockout (ECPL) training program which used the *instructor led approach* (ILA) and workers who participated in second ECPL training program that used the *interactive video disk* (IVD) approach. The subject matter in the ECPL training program was exactly the same in both the training programs. A total of 378 employees at a major auto company participated in the study. Of this number, 286 (75.7%) participants were in the ILA Group and 92 (24.3%) were in the IVD group.

Results of the data analysis are divided into two sections. The first section provides a description of the two groups using crosstabulations. Inferential statistical analyses were used to address each of the research questions posed for this study. These results are presented in the second section.

## Description of the Sample

The participants completed a short demographic questionnaire. They provided their age, gender, and highest level of education on this survey. Their responses were crosstabulated by group membership for presentation in Table 4.

Table 4

A Description of the Personal Characteristics of the Participants

| Personal Characteristic | Type of Group | | | | Total (N=378) | |
|---|---|---|---|---|---|---|
| | ILA (n=286) | | IVD (n=92) | | | |
| | N | % | N | % | N | % |
| Age | | | | | | |
| Less than 36 | 44 | 15.7 | 33 | 35.9 | 77 | 20.7 |
| 36 to 45 | 103 | 36.8 | 33 | 35.9 | 136 | 36.6 |
| 46 to 55 | 82 | 29.3 | 20 | 21.7 | 102 | 27.4 |
| Greater than 55 | 51 | 18.2 | 6 | 6.5 | 57 | 15.3 |
| Missing | (6) | | | | (6) | |
| Gender | | | | | | |
| Male | 268 | 95.7 | 71 | 78.9 | 339 | 91.6 |
| Female | 12 | 4.3 | 19 | 21.1 | 31 | 8.4 |
| Missing | (6) | | (2) | | (8) | |
| Educational Level | | | | | | |
| Less than high school | 41 | 14.6 | 6 | 6.8 | 47 | 12.7 |
| High School | 70 | 24.9 | 24 | 27.3 | 94 | 25.5 |
| Trade sch/some coll | 145 | 51.7 | 31 | 35.2 | 176 | 47.7 |
| Bachelor's Degree | 17 | 6.0 | 21 | 23.9 | 38 | 10.3 |
| Post Bchlor's Degree | 8 | 2.8 | 6 | 6.8 | 14 | 3.8 |
| Missing | (5) | | (4) | | (9) | |

The largest group of the participants (n=136, 36.6%) was between 36 and 45 years of age. In the ILA group, 103 (36.8%) participants were this age, with 33 (35.9%) of the participants in the IVD group were in this age. Eighty-two (29.3%) participants in the ILA group and 20 (21.7%) in the IVD group were between 46 and 55 years of age. Six participants in the ILA group did not provide their ages on the survey.

The majority of the participants (n=339, 91.6%) reported their gender as male. Of this number, 268 (95.7%) were in the ILA group and 71 (78.9%) were in the IVD group.

Six members of the ILA group and two members of the IVD group did not indicate their gender on the survey. When the highest level of education was examined, trade school/some college was reported by 176 (47.7%) of the employees. This number included 145 (51.7%) of the ILA group and 31 (35.2%) of the IVD group. Forty-one (14.6%) of the participants in the ILA group and 6 (6.8%) of the participants in the IVD group had not completed high school, with 8 (2.8%) of the ILA group and 6 (6.8%) of the IVD group had post-bachelor's degrees. Five members of the ILA group and 4 members of the IVD group did not provide a response to this question.

The participants in both groups were asked to indicate the number of years they had worked for the auto company and the number of years they had worked in their present position. The responses to these questions were crosstabulated by group membership. Table 5 presents the results of these analyses.

Table 5

A Description of Participants' Professional Experiences

| Professional Experiences | Type of Group | | | | Total (N=378) | |
|---|---|---|---|---|---|---|
| | ILA (n=286) | | IVD (n=92) | | | |
| | N | % | N | %t | N | % |
| Years at Auto company | | | | | | |
| 0 to 5 years | 6 | 2.1 | 47 | 52.8 | 53 | 14.3 |
| 6 to 10 years | 7 | 2.5 | 2 | 2.2 | 9 | 2.4 |
| 11 to 15 years | 54 | 19.1 | 9 | 10.1 | 63 | 17.0 |
| 16 to 20 years | 66 | 23.4 | 23 | 25.9 | 89 | 24.0 |
| More than 20 years | 149 | 52.8 | 8 | 9.0 | 157 | 42.3 |
| Missing | (4) | | (3) | | (7) | |
| Years in Present Position | | | | | | |
| 0 to 5 years | 108 | 38.3 | 72 | 80.9 | 180 | 48.5 |
| 6 to 10 years | 34 | 12.1 | 9 | 10.1 | 43 | 11.6 |
| 11 to 15 years | 44 | 15.6 | 1 | 1.1 | 45 | 12.1 |
| 16 to 20 years | 36 | 12.8 | 6 | 6.7 | 42 | 11.3 |
| More than 20 years | 60 | 21.3 | 1 | 1.1 | 61 | 16.4 |
| | (4) | | (3) | | (7) | |

The majority of participants in the ILA group (n=149, sd=52.8%) had worked for The auto company for more than 20 years. In contrast, 8 (9.0%) of the participants in the IVD group had been employed for this length of time. Of the 89 (24.0%) participants who had worked for major auto company from 16 to 20 years, 66 (23.4%) were in the ILA group and 23 (25.9%) were in the IVD group. Six (2.1%) respondents in the ILA group and 47 (52.8%) in the IVD group had worked for an auto company for 0 to 5 years. Four members of the ILA group and 3 members of the IVD group did not provide a response to this question.

The largest group of participants (n=180, 48.5%) had worked in their present

positions for 1 to 5 years. Of this number, 108 (38.3%0 were in the ILA group and 72 (80.9%) were in the IVD group. Sixty (21.3%) participants in the ILA group and 1 (1.1%) of members of the IVD group had worked in their present positions for more than 20 years. Four participants in the ILA group and 3 members of the IVD group did not provide a response to this question.

The participants were asked to indicate their employment status (hourly or salary) on the survey. Their responses were crosstabulated by type of group for presentation in Table 6.

Table 6

A Description of Participants'Employment Status

| Employment Status | Type of Group | | | | Total (N=378) | |
|---|---|---|---|---|---|---|
| | ILA (n=286) | | IVD (n=92) | | | |
| | N | % | N | % | N | % |
| Hourly | 221 | 77.8 | 63 | 70.0 | 284 | 75.9 |
| Salary | 63 | 22.2 | 27 | 30.0 | 90 | 24.1 |
| Total | 284 | 100.0 | 90 | 100.0 | 374 | 100.0 |

Missing ILA 2, IVD 2

The majority of the respondents (n=284, 75.9%) reported they were hourly. Of this number, 221 (77.8%) were in the ILA group and 63 (70.0%) were in the IVD group. Of the 90 (24.1%) participants who were salaried, 63 (22.2%) were in the ILA group and 27 (30.0%) were in the IVD group. Two participants in each group did not provide a response to this question.

The participants were asked if they had attended previous ECPL training programs. Their responses were crosstabulated by group membership and they are

presented in Table 7.

Table 7

Participants' Previous ECPL Training Program Attendance

| Attended Previous ECPL Training Programs | Type of Group | | | | Total (N=378) | |
|---|---|---|---|---|---|---|
| | ILA (n=286) | | IVD (n=92) | | | |
| | N | % | N | % | N | % |
| Yes | 84 | 31.0 | 47 | 52.2 | 131 | 36.3 |
| No | 187 | 69.0 | 43 | 47.8 | 230 | 63.7 |
| Total | 271 | 100.0 | 90 | 100.0 | 361 | 100.0 |

Missing ILA 15
IVD 2

The majority of the participants (n=230, 63.7%) had not completed training prior to the program in which they were currently enrolled. This number included 187 (69.0%) participants in the ILA group and 43 (47.8%) in the IVD group. Eighty-four (31.0%) members of the ILA group and 47 (52.2%) of participants in the IVD group had attended previous ECPL training programs. Fifteen members of the ILA group and 2 members of the IVD program did not provide a response tot his question.

## Research Questions

Four research questions were developed for this study. Each of these questions was answered using inferential statistical analyses, with all decisions on the significance of the findings made using an alpha level of .05.

Question 1:

What is the difference in trainee composite ECPL knowledge retention of processes as a function of type of programs (Lecture/video or IVD).

The participants completed a cognitive test to determine their knowledge level following completion of the ECPL training program. Composite scores on this test were compared between the ILA and IVD groups using the t-test for two independent samples. Table 8 presents the results of this analysis.

Table 8

t-Tests for Two Independent Samples
Achievement by Group Membership

| Group | N | Mean | SD | DF | t-Value | Sig of t |
|---|---|---|---|---|---|---|
| ILA Group | 286 | 17.92 | 2.19 | 376 | -.08 | .935 |
| IVD Group | 92 | 17.95 | 2.61 | | | |

The comparison of the ILA group and the IVD group on achievement following completion of the ECPL training program produced a t-value of -.08, which was not statistically significant at an alpha level of .05 with 376 degrees of freedom. This result indicated that the type of training program, ILA or IVD, did not result in difference in achievement.

Question 2.

What is the difference between trainee attitude towards safety as a function of the type of program (Lecture/video or IVD)

The results of the analysis of attitude toward safety questions are presented inTable 9.

Table 9
Univariate F Tests
Attitudes toward Safety by Group Membership

| Perceptions of trainee attitudes toward safety | N | Mean | SD | DF | F Ratio | Sig of F |
|---|---|---|---|---|---|---|
| The safety risks of my job, concerns me quite a bit. | | | | | | |
| ILA Group | 277 | 4.62 | 0.65 | 1, 360 | 2.7 | 0.10 |
| IVD Group | 85 | 4.48 | 0.77 | | | |
| I have the authority and responsibility to lockout an operation before I work on it. | | | | | | |
| ILA Group | 277 | 4.64 | 0.61 | 1 360 | 4.5 | 0.03 |
| IVD Group | 85 | 4.46 | 0.89 | | | |
| If I choose not to lockout operations, machines or equipment before I work on them, I will be held accountable for my decision. | | | | | | |
| ILA Group | 277 | 4.21 | 0.93 | 1 360 | 0.2 | 0.63 |
| IVD Group | 85 | 4.26 | 0.79 | | | |
| Before starting a job, how often do you consciously evaluate the consequences of not doing the job safely | 277 | 4.22 | 1.00 | 1 360 | 1.3 | 0.25 |
| ILA Group | 85 | 4.08 | 1.10 | | | |
| IVD Group | | | | | | |

Examining the three "attitude toward safety" related questions in Table 9, it is seen that only one of the questions pertaining to "authority and responsibility to lockout", the two groups are significantly different. On the first question "safety risks of my job concerns me", the two groups showed no significant difference. The members of the ILA group has a mean=4.62 and S.D=0.65, the IVD group has a mean of 4.48 and S.D of 0.77. This indicates that the participants of both the groups had similar perceptions on "Safety

risks of the job they are working on". The two groups are significantly different on the perceptions of the second question. The ILA group has a mean=4.64 and S.D of 0.61, whereas IVD group mean=4.46 and S.D=0.69. The difference in their means is very small but the S.D of the IVD group indicates less cohesiveness in responses. The third question pertaining to "accountability on the decision of not locking out" ILA group mean is 4.21 and IVD group mean is 4.26, the difference being 0.05, but their S.Ds show a difference of 0.14 indicating more variance in the responses of the ILA group.

The fourth question pertaining to "Consciously evaluating the consequences of not doing the job safely" ILA group mean is 4.22 and IVD group mean is 4.08, the difference being 0.14, but their S.Ds show a difference of 0.10 indicating little variance in the responses of the ILA group.

Question 3

What is the difference between trainee perceptions of management attitudes toward safety as a function of type of program (Lecture/video or IVD)? Management attitude toward safety will be interpreted in terms of:

a: Perceptions of organizational lockout behavior.

Table 10 gives question by question summary of responses to see the differences in trainee perceptions of management attitude toward safety in terms of organizational lockout behavior by group membership.

Table 10
Univariate F Tests
Trainee Perceptions of Management Attitudes in terms of
organizational lockout behavior by Group Membership

| Perceptions of Management Attitudes | N | Mean | SD | DF | F Ratio | Sig of F |
|---|---|---|---|---|---|---|
| At my plant, management and the Union support job safety. | | | | | | |
| ILA Group | 208 | 4.36 | 0.71 | 1, 295 | 1.3 | 0.25 |
| IVD Group | 88 | 4.45 | 0.60 | | | |
| In my plant workers who do not follow good safety practices irritate their fellow workers even when no one gets hurt. | | | | | | |
| ILA Group | 208 | 3.80 | 0.90 | 1, 295 | 1.8 | 0.18 |
| IVD Group | 88 | 3.95 | 0.90 | | | |
| Supervisors in my plant appreciate it when I tell them about safety hazards, and they try to get them corrected quickly. | | | | | | |
| ILA Group | 208 | 3.66 | 0.94 | 1, 295 | 3.0 | 0.08 |
| IVD Group | 88 | 3.86 | 0.85 | | | |
| Our plant manager is well informed about safety issues in our plant. | 208 | 3.91 | 0.89 | 1, 295 | 0.1 | 0.81 |
| ILA Group | 88 | 3.89 | 0.88 | | | |
| IVD Group | | | | | | |
| Working safely is the number 1 priority in my plant. | | | | | | |
| ILA Group | 208 | 4.04 | 0.94 | 1, 295 | 0.2 | 0.68 |
| IVD Group | 88 | 4.09 | 0.87 | | | |
| The union and the company really want the workers to lockout. | | | | | | |
| ILA Group | | 4.29 | 0.74 | 1, 295 | 0.03 | 0.86 |
| IVD Group | 208 | 4.27 | 0.67 | | | |
| | 88 | | | | | |

Results of Manova are tabulated on the six questions related to "perceptions of

management attitudes toward safety in terms of organizational lockout behavior". In all none of the questions show any significance. On the first question "At my plant, management and the Union support job safety", the two groups showed no significant difference. The members of the ILA group has a mean = 4.36 and S.D=0.71, the IVD group has a mean of 4.45 and S.D of 0.60. This indicates that both the groups had similar perceptions on "management and the union support about job safety". On the second question relating to "safety practices of fellow workers" the two groups show no significant difference. The ILA group show a mean=3.8 and S.D=0.9, and the IVD group mean=3.9 and S.D=0.9. The third question relating to perceptions about "supervisors' appreciation about employee concerns of safety hazards", although the two groups are not significantly different, but they show more variance in their responses, the ILA group mean=3.66 and S.D=0.94, whereas IVD group mean=3.86 and S.D=0.85. The fourth question relates to perceptions of trainees regarding "manager's awareness about safety issues at the plant". Again the ILA group mean=3.91 with S.D=0.89 and IVD group mean=3.89 and S.D=0.88, with no significant difference in their perceptions. The fifth question on the perception of "safety as number 1 priority" the two groups show no significant difference. The ILA group mean was 4.04 with S.D of 0.94, whereas IVD group mean was 4.09 and S.D of 0.87. The sixth question was related to perceptions of trainees on "the union and company really want the workers to lockout". On this question also both the ILA and IVD group showed no significant difference in their opinions. The ILA group mean was 4.29 with S.D of 0.74, whereas the IVD group mean was 4.27 and S.D being 0.67.

Question 3b.

What is the difference between trainee perceptions of management attitudes toward safety as a function of type of program (Lecture/video or IVD)? Management attitude toward safety will be interpreted in terms of:

b: Perceptions of general management attitudes toward safety.

To determine if perceptional differences exist between the ILA and IVD groups. Results of Manova are tabulated on the five questions related to "perceptions of management attitudes toward safety in terms of general management attitude toward safety". The results are summarized in Table 11.

Table 11
Univariate F Tests

Trainee Perceptions of Management Attitude Towards Safety by Group Membership

| Perceptions of Management Attitudes toward safety | N | Mean | SD | DF | F Ratio | Sig of F |
|---|---|---|---|---|---|---|
| Operations and equipment on my plant have been designed so that they can be easily locked out. | | | | | | |
| ILA Group | 258 | 3.98 | 0.83 | 1, 325 | 0.5 | 0.465 |
| IVD Group | 68 | 3.90 | 0.87 | | | |
| It is not a common practice in my plant to defeat safety interlocks. | | | | | | |
| ILA Group | 258 | 3.71 | 1.03 | 1, 325 | 1.3 | 0.250 |
| IVD Group | 68 | 3.87 | 1.04 | | | |
| When is it necessary for every one working on operations or equipment to put their lock on the power or energy source? | | | | | | |
| ILA Group | 258 | 4.75 | 0.74 | 1, 325 | 0.02 | 0.898 |
| IVD Group | 68 | 4.76 | 0.71 | | | |
| How often does a worker in your plant not lockout all sources of power and energy because he or she does not have enough locks?. | | | | | | |
| ILA Group | 258 | 3.95 | 1.08 | 1 , 325 | 0.2 | 0.634 |
| IVD Group | 68 | 4.01 | 1.01 | | | |
| In your work assignments, how often is it impossible to lockout or control all sources of power and energy?. | | | | | | |
| ILA Group | 258 | 4.15 | 1.03 | 1, 325 | 0.9 | 0.342 |
| IVD Group | 68 | 4.28 | 0.97 | | | |

On the first question "Operations and equipment on my plant have been designed so that they can be easily locked out", the two groups show no significant difference. The members of the ILA group has a mean = 3.98 and S.D=0.83, the IVD group has a mean of

3.90 and S.D of 0.87. This indicates that both the groups had similar perceptions on the issue in question. On the second question relating to "Common practice in my plant to defeat safety interlocks" the two groups show no significant difference. The ILA group show a mean=3.71 and S.D=1.03, and the IVD group mean=3.87 and S.D=1.04. The mean and S.D are almost same. The third question relating to perceptions about "the necessity for every one working on operations or equipment to put their lock on the power or energy source", the two groups are not significantly different and do not show any variance in their responses, the ILA group mean=4.75 and S.D=0.74, whereas IVD group mean=4.76 and S.D=0.71. The fourth question relates to perceptions of trainees regarding "How often does a worker in your plant not lockout all sources of power and energy because he or she does not have enough locks?" Again the ILA group mean=3.95 with S.D=1.08 and IVD group mean=4.01 and S.D=1.01, with no significant difference in their perceptions. The fifth question on the perception of "Work assignments, how often is it impossible to lockout or control all sources of power and energy", the two groups show no significant difference. The ILA group mean was 4.14 with S.D of 1.03, whereas IVD group mean was 4.28 and S.D of 0.97.

Question 4a.

What is the difference between trainee performance as a function of type of program (Lecture/video or IVD)? Trainee performance will be interpreted in terms of:

a. Post-training lockout performance.

Results of manova inTable 12 illustrate the differences if any by group membership in terms of training lockout performance as perceived by the trainees.

Table 12
Univariate F Tests
Post Training Lockout Performance
Perceptions of Trainee Performance by Group Membership

| Perceptions of Trainee Performance | N | Mean | SD | DF | F Ratio | Sig of F |
|---|---|---|---|---|---|---|
| How often do you lockout power and control energy before you work in a machine or on equipment? | | | | | | |
| ILA Group | 259 | 3.58 | 1.30 | 1, 325 | 13.3 | 0.0 |
| IVD Group | 67 | 4.21 | 1.11 | | | |
| How often are departmental locks used at your plant when, equipment machines, or operations will be down into the next shift or longer? | | | | | | |
| ILA Group | 259 | 2.86 | 1.45 | 1, 325 | 19.2 | 0.0 |
| IVD Group | 67 | 3.70 | 1.22 | | | |
| In the last month, before I worked on a machine, operation, or equipment I locked out power and control energy. | | | | | | |
| ILA Group | 259 | 3.59 | 1.46 | 1, 325 | 6.0 | 0.0 |
| IVD Group | 67 | 4.06 | 1.18 | | | |

It is noticed that the items reflecting the trainee performance significantly differed between ILA and IVD groups. Item first, lockout power and control energy before working in a machine or equipment ILA group had a mean of 3.58 and S.D 1.30 while IVD group had a mean of 4.21 and S.D of 1.11, implying that IVD group members had higher perceptions towards performance. As to the second item, " How often are departmental locks used at your plant when, equipment machines, or operations will be down into the next shift or longer?" the ILA group had a mean of 2.86 and S.D of 1.45 while IVD group had a mean of 3.70 with S.D 1.22. Once again the IVD group had higher perceptions in this case towards performance. Similarly on the third item, " In the last month, before I worked on a machine, operation, or equipment I locked out power and control energy" the ILA group had a mean=3.59 and S.D=1.46, while IVD group had

a mean of 4.06 and S.D of 1.18 showing a higher perceptions towards performance in favor of IVD group.

Question 4b

What is the difference between trainee performance as a function of type of program (Lecture/video or IVD)? Trainee performance will be interpreted in terms of:

b. Failure to follow lockout procedures.

Table 13 below gives the results of Manova pertaining to the two items on the questionnaire.

Table 13
Univariate F Tests
Failure to Lockout Procedures
Perceptions of Trainee Performance by Group Membership

| Perceptions of Trainee Performance | N | Mean | SD | DF | F Ratio | Sig of F |
|---|---|---|---|---|---|---|
| Supervisors in my plant may say I should lockout, but when push comes to shove and an operation is down, they really don't care and just want to get the operation up as soon as possible, no matter what it takes. | | | | | | |
| ILA Group | 271 | 3.11 | 1.24 | 1 , 350 | 3.4 | 0.06 |
| IVD Group | 80 | 2.83 | 1.10 | | | |
| How often, because of the pressure to get the job back in operation, do you not lockout or control power and energy. | | | | | | |
| ILA Group | 271 | 2.18 | 1.30 | 1 , 350 | 0.1 | 0.78 |
| IVD Group | 80 | 2.14 | 1.56 | | | |

The results indicate that the items reflecting the trainee performance in terms of failure to lockout procedures, show no significant difference between ILA and IVD groups. Item first, "Supervisors in my plant may say I should lockout, but when push

comes to shove and an operation is down, they really don't care and just want to get the operation up as soon as possible, no matter what it takes." ILA group had a mean of 3.11 and S.D 1.24 while IVD group mean=2.83 and S.D=1.10, although the mean and standard deviations show sizable difference, still it is not significant. The second item tested, "How often, because of the pressure to get the job back in operation, do you not lockout or control power and energy." The ILA group indicates a mean=2.18 and S.D=1.30 and IVD group mean=2.14 and S.D=1.56. Both the groups show mean and standard deviation difference but they are not significantly different.

# Chapter 4

## Discussion of Findings

### Overview of the Study

Most of the training programs at the major auto company in this study used the traditional instructor-led style, later there was a change towards utilizing Interactive Video Disk (IVD) technology. The first Energy Control and Power Lockout (ECPL) training program was delivered in a lecture, videotape, discussion, format. The second used the interactive videodisc. Both the programs educated the trainees in Energy Control and Power Lockout procedures for primary and secondary energy sources. The instructional material used in both the training programs was exactly the same and the trainee population of both the training programs consisted of hourly and salaried employees at the auto company. In both the programs identical pre and post-test questionnaires were used. All instruments used in both the training programs were researched, examined and approved by the Union and Company management. The participants completed the pre-test questionnaires before the training and post-test questionnaire within a period of one to three months after training. Learners entered the training with a high degree of knowledge of the correct ECPL procedures, good safety attitudes, and reportedly good ECPL work practices (Richey, 1992).

Since there has been controversy regarding the merits of research comparing the outcomes of different instructional methods and different instructional media, the present study was undertaken to see whether there were any significant differences in the training outcomes of knowledge, attitude towards safety, trainee perceptions of organizational lockout behavior, trainee perceptions of general management attitude toward safety, on-

the-job lockout performance and failure to follow lockout procedures; between the groups that had different types of delivery for instruction during their training. The study used existing post-test databases of both studies to compare the relative achievement of the workers who participated in both the ECPL training programs.

## Conclusions

When the knowledge composite score of the ECPL program was compared between the two groups, no significant differences were found. Knowledge scores for both groups were 69.05% for ILA group and 78.45 for the IVD group. An examination of mean scores for the five subscales measuring (attitudes toward training content perceptions of personal view of safety, perceptions of management support for safety performance, problems associated with safety lockout, and failure to follow lockout procedures) indicated that employees in both groups indicated positive attitudes. Each program (ILA and IVD) offered benefits not available in the other program. For example, interacting with other students and being able to ask questions may have benefited some learners who generally learn best using lecture, group interaction (ILA) approach, while the IVD group members may have benefited from being able to review the IVD more than once, while mastering the materials.

Prior knowledge of employees also may have contributed to these results. When employees have been exposed to training previously, their prior learning is reinforced and they have a greater opportunity to improve their knowledge. According to Bloom (1984), prior knowledge is of primary importance when learning new theory and procedures. To test this conjecture the pre-test scores for these groups were compared[1].

1 Please refer to tables in Appendix (D)

When examining the composite knowledge scores of pre and post tests of the ILA group (ECPL training program I), it is seen that the ILA group with sample size 389(pre-test) and 284(post-test) shows a significant knowledge gain. The percentage of correct answers is 66.9 on pre test and 78.3 on post-test, showing 11.4% increase in scores after intervention. The scores also indicate that the participants were fairly knowledgeable prior to the training program. The S.D of 3.16 for pre-test and S.D of 1.93 for post-test also indicate that the variance in their S.D has been reduced substantially by 1.23 indicating positive outcomes of the program.

The participants in the IVD instructed program (ECPL training program II) also demonstrated significant gains in their knowledge of ECPL procedures. Overall, the trainees increased their knowledge scores by 9.4% points, from 69.05% to 78.45%. Again the S.D (1.827) of post-test scores have been substantially reduced from pre-test S.D (2.667) showing a reduction in variance by 0.84, indicating less variance in post-test responses. The data indicates that the participants in both the programs (31% of the first ECPL training program and 51% of the second ECPL training program) were exposed to similar training that prepared them for the current training, leading to positive attitudes and improved outcomes, which was supported through an examination of the mean scores for each group. Based on outcomes of the study, it appeared that learning had occurred and employees' perceptions of the program were positive regardless of the type of media used for training. As the data for post-test was collected 30 to 90 days after completion of the training, it appears that employees retained the information contained in the training.

Richey (1992) discussing on the implications of ECPL-IVD says, " Interactive videodisc technology provides attractive features of large-scale training endeavors. It

offers the possibilities of effective instruction, which is individualized, efficient for trainers and trainees, and less costly for organizations with a large volume of training. "

Lectures, video tapes, training manuals, etc., are the most common methods of on-the-job training. The analysis of the comparisons in Chapter 3 and the support from literature leads to a conclusion that there is no significant difference in outcomes of the lecture-based and IVD based training. If there is no significant difference in the delivery outcomes, then the critical question relates to which method of training is most cost effective, time saving, and offers flexibility of schedule.

Advantages to the Trainer or Organization: Some of the outstanding advantages and disadvantages with respect to the trainer or organization listed by (Chappell, 2002) are as follows:

- Reduce Overall Cost. The single most influential factor in adopting Technology Based Training (TBT) is the elimination of costs associated with instructors' salaries, meeting-room rentals, and student travels, lodging, and meals, is directly quantifiable. The reduction of employees' time spent away from the job may be the most positive offshoot.
- Learning times are reduced an average of 40 to 60 percent.
- Increased retention of information and its application to the job averages an increase of 25 percent over traditional methods.
- Consistent delivery of content that would be diluted by filtering through instructors is possible with TBT.
- Expert knowledge is communicated, but more importantly captured, with TBT.

- Proof of completion and certification, essential elements of training initiatives, can be automated.

Disadvantage to the trainer or the organization. Compared to the advantages, the disadvantages to the organization or the trainer are minimal and can be circumvented in many ways.

- Up-front investment required of a TBT solution is larger than for traditional approaches due to development costs.
- Technology issues that play a role include whether the existing technology infrastructure can accomplish the training goals. Additional technology expenditures can be justified, and whether compatibility of all software and hardware can be achieved.

Advantages to the learner: Along with increased retention, reduced learning time, and the other aforementioned benefits, particular advantages of TBT for students include the following:

- On-demand availability allows students to complete training conveniently;
- Self-pacing for slow or quick learners, reduces stress and increases satisfaction (The material included in the course module can be reviewed as many times as necessary);
- Interactivity engages users, pushing them rather than pulling them through training, and
- Confidence that refresher or quick reference materials are available reduces the burden of responsibility of mastery.

Disadvantage to the learner. Technology is utilized only to assist and enhance the capabilities of the user, but still there are disadvantages that are dependent upon the limitations and applications.

- Technology issues of learners are most commonly technology phobia and unavailability of required technologies.
- Reduced social and cultural interaction between the learners can be a drawback but this can be overcome by providing facilities of interaction during or after the training period

## The Future Use of Technology

Over the past fifty years the impact of technology, especially computers, has influenced our society practically creating social change. Computers have invaded our homes as well as institutions of learning and work places. Young adults and children spend large periods of time using the computer, working on their academic assignments, using email, computer chatting, or using the World Wide Web (WWW). WWW has brought some basic changes to teaching and learning, strategies especially in terms of self-directed Web-Based training. As Dodge (2002) states "The arrival of the World Wide Web signals the beginning of some fundamental changes in how teaching, training, and self-directed learning will occur at all ages and stages of life."

Web Based Training (WBT) is similar to Computer-Based Training (CBT) only the technology and methodology of World Wide Web is different. One can present live content in a structure allowing self-directed, self-paced instruction on any topic. It can be delivered to groups or individuals in any form of setting, ranging from a classroom to the confines of a bedroom.

Education and training using the World Wide Web is becoming popular. "MCI WorldCom slashed approximately $3 million in travel, facility, and labor costs over a year by offering 20 percent of its classes over the web. The company uses expected to increase this to 50 percent in 1999 (Brown, cited Greengard, 2000). By switching from classroom to web-based training, some companies have realized up to 75 percent savings in their training budgets, making this mode of training especially appealing to companies that have large numbers of employees to train (Brown, Cited Cole-Gomolski, 2000). Travel expenses, instructor fees, facility costs, materials, and office equipment costs, in addition to the cost of lost time on the job when employees are in training represents some of the savings that are realized through Web-based training."

Richey (1992) discussing on the implications of ECPL-IVD findings says, "Interactive videodisc technology provides attractive features for large-scale training endeavors. It offers the possibilities of effective instruction, which is individualized, efficient to trainers

Lessons learned from this study Brogan (1992) summarizing the results of her study states that " Significant changes occurred from start to the end of the training in learner's perceptions of the environment. As their confidence operating the equipment increased, the amount of help they received with it decreased. As their confidence in learning from the program increased, their attention increased, the number of times they repeated parts of the program decreased, and the amount of discussion they had regarding technical aspects of the program decreased." (p. 101)

Richey (1992) in the summary of her findings points out " Almost all trainees reacted favorably to the delivery system. Interactive videodisc is more likely to impact

knowledge than trainee attitudes or on-the-job behavior." (p. 54)

Recommendations for Further Research

The following recommendations should be considered to test the effectiveness of training methods in an industrial setting:

- Replicate this study, using a different type of training program to determine if delivery methods result in differential results in attitudes toward training content and knowledge.
- Study changes in employee's work behavior that reflect knowledge gained from participation in training to determine if employees are applying the principles learned as part of their training programs.
- Examine attitudes toward instructional delivery method to determine if employees prefer learning in small groups using an instructor-led approach or alone using multimedia at their own pace.

# Appendix (A)

**Instructor Led Energy Control And Power Lockout**
**Safety Attitude and Knowledge Evaluation Survey**

Place a check on the line next to the number of the responses that best describes how you feel about what has been said in the question.

1. At my plant, management and the Union support job safety.

   1 ---------- Strongly agree
   2 ---------- Agree
   3 ---------- Neither agree nor disagree
   4 ---------- Disagree
   5 ---------- Strongly disagree

2. The safety risks of my job, concerns me quite a bit.

   1 ---------- Strongly agree
   2 ---------- Agree
   3 ---------- Neither agree nor disagree
   4 ---------- Disagree
   5 ---------- Strongly disagree

3. In my plant, workers who do not follow good safety practices irritate their fellow workers even when no one gets hurt.

   1 ---------- Strongly agree
   2 ---------- Agree
   3 ---------- Neither agree nor disagree
   4 ---------- Disagree
   5 ---------- Strongly disagree

4. Supervisors in my plant appreciate it when I tell them about safety hazards, and they try to get them corrected quickly.

   1 ---------- Very satisfied
   2 ---------- Satisfied
   3 ---------- Neither satisfied nor dissatisfied
   4 ---------- Dissatisfied
   5 ---------- Very dissatisfied

5. Our plant manager is well informed about safety issues in our plant.

   1 ---------- Strongly agree
   2 ---------- Agree
   3 ---------- Neither agree nor disagree
   4 ---------- Disagree
   5 ---------- Strongly disagree
   0 ---------- I don't have enough information to answer this question

6. I have the authority and the responsibility to lockout an operation before I work on it.
   1 --------- Strongly agree
   2 --------- Agree
   3 --------- Neither agree nor disagree
   4 --------- Disagree
   5 --------- Strongly disagree

7. Operations and equipment on my plant have been designed so that they can be easily locked out.

   1 --------- Strongly agree
   2 --------- Agree
   3 --------- Neither agree nor disagree
   4 --------- Disagree
   5 --------- Strongly disagree

8. If I choose not to lock out operations, machines or equipment before I work on them, I will be held accountable for my decision.

   1 --------- Strongly agree
   2 --------- Agree
   3 --------- Neither agree nor disagree
   4 --------- Disagree
   5 --------- Strongly disagree

9. Working safely is the number 1 priority in my plant.

   1 --------- Strongly agree
   2 --------- Agree
   3 --------- Neither agree nor disagree
   4 --------- Disagree
   5 --------- Strongly disagree

10. It is not a common practice in my plant to defeat safety interlocks.

   1 --------- Strongly agree
   2 --------- Agree
   3 --------- Neither agree nor disagree
   4 --------- Disagree
   5 --------- Strongly disagree

11. Supervisor in my plant may say I should lockout, but when push comes to shove and an operation is down, they really don't care and just want to get the operation up as soon as possible, no matter what it takes.

   1 --------- Strongly agree
   2 --------- Agree
   3 --------- Neither agree nor disagree
   4 --------- Disagree
   5 --------- Strongly disagree

12. The union and the company really want the workers to lockout.

    1 --------- Strongly agree
    2 --------- Agree
    3 --------- Neither agree nor disagree
    4 --------- Disagree
    5 --------- Strongly disagree

13. How often do you lockout power and control energy before you work in a machine or on equipment?

    1 --------- Always
    2 --------- More often than not
    3 --------- Some times
    4 --------- Occasionally
    5 --------- Hardly ever

14. How often are departmental locks used at your plant when, equipment machines, or operations will be down into the next shift or longer?

    1 --------- Always
    2 --------- More often than not
    3 --------- Some times
    4 --------- Occasionally
    5 --------- Hardly ever

15. When is it necessary for every one working on operations or equipment to put their lock on the power or energy source?

    1 --------- Always
    2 --------- More often than not
    3 --------- Some times
    4 --------- Occasionally
    5 --------- Hardly ever

16. Before starting a job, how often do you consciously evaluate the consequences of not doing the job safely?

    1 --------- Always
    2 --------- More often than not
    3 --------- Some times
    4 --------- Occasionally
    5 --------- Hardly ever

17. How often, because of the pressure to get the job back in operation, do you not lockout or control power and energy:

    1 --------- Always
    2 --------- More often than not
    3 --------- Some times
    4 --------- Occasionally
    5 --------- Hardly ever

18. In the last month, before I worked on a machine, operation, or equipment I locked out power and control energy:.

    1 --------- Always
    2 --------- More often than not
    3 --------- Some times
    4 --------- Occasionally
    5 --------- Hardly ever

19. When is it OK to loan your lock to a fellow worker?

    1 --------- Never
    2 --------- Occasionally
    3 --------- Some times
    4 --------- More than not
    5 --------- Always

20. How often does a worker in your plant not lockout all sources of power and energy because he or she does not have enough locks?

    1 --------- Never
    2 --------- Occasionally
    3 --------- Some times
    4 --------- More than not
    5 --------- Always

21. In your work assignments, how often is it impossible to lockout or control all sources of power and energy?

    1 --------- Never
    2 --------- Occasionally
    3 --------- Some times
    4 --------- More than not
    5 --------- Always

Place a check on the line next to the number of the response that is the best answer to the following questions.

22. As soon as you have decided to lockout you should first:

    1 -------- Do it immediately
    2 -------- Communicate with the necessary personnel
    3 -------- Prepare the area

23. Preparing the area for lockout means:

    1 -------- Checking the hazards
    2 -------- Doing something about the hazards
    3 -------- Both of the above

24. Before locking out a specific machine, it is important to decide whether adjacent machinery requires lockout too.

    1 -------- True
    2 -------- False

25. Once you have worked on a piece of machinery a few times and know it well, you can assume you can lock it out safely.

    1 -------- True
    2 -------- False

26. Once you know the principles of lockout, you should be able to lockout any machine.

    1 -------- True
    2 -------- False

27. Effectively locking out a machine fed be multiple energies often requires that you use more than one lock.

    1 -------- True
    2 -------- False

28. In locking out, air, oil, water, steam, or gas under pressure:

    1 -------- Must be dissipated
    2 -------- Must be released

29. Which of the following a re proper disconnect points for a pneumatic system?

    1 -------- Piston valve
    2 -------- Handle / Lever valve
    3 -------- Gate valve
    4 -------- All of the above

30. Which of the following are the acceptable electrical disconnects.

    1 -------- On-off button
    2 -------- Selector switch
    3 -------- Toggle switch
    4 -------- Manually operated disconnect switch
    which can be locked in the off position

31. Stored energy cannot always be locked out.

    1 --------- True
    2 -------- False

32. Mechanical motion must be :

    1 --------- Controlled
    2 --------- Dissipated

33. Gravity must be:

    1 -------- Controlled
    2 -------- Dissipated

34. Stored mechanical energy in springs may be controlled or dissipated.

    1 --------- True
    2 -------- False

35. Safety blocks are built to withstand the force of the cycling machinery for which they are built.

    1 -------- True
    2 -------- False

36. When releasing hydraulic pressure, it is sometimes necessary to check, or to have qualified person check, that the pressure has been released by breaking a line at a fitting.

    1 -------- True
    2 -------- False

37. When making sure that pneumatic energy is absent, pressure gauges alone are enough to tell you that the pneumatic energy is absent.

    1 --------- True
    2 --------- False

38. When working in a team you should make sure that each person has placed a safety lock on each appropriate disconnect.

    1 --------- True
    2 --------- False

39. If you have to leave a job site after controlling and locking out power and energy and making sure that power and energy are absent, then as soon as you return to the job you should:

    1 --------- Continue work
    2 --------- Again make sure power and energy are controlled or locked out

40. When pulling electrical disconnect switches you should:

    1 --------- Face away from the panel box or cabinet
    2 --------- Face the panel box or cabinet

41. If you intend to work in a confined space that has a Carbondioxide fire extinguishing system, you should lock the system out before entering the confined space.

    1 --------- True
    2 --------- False

42. Whenever you need to lockout, all you should concern yourself with is locking out the machine on which you are working.

    1 --------- True
    2 --------- False

43. It is your responsibility to make sure that the safety guards you removed during your work are put back properly after your work is done.

    1 --------- True
    2 --------- False

## ECPL Evaluation survey Background Information

Fill in the blanks or place a check mark next to the responses that best describes you or how you feel about what has been said in the question asked.

44. Your age is

1 --------- Less than 25
2 --------- 25-35
3 --------- 36-45
4 --------- 46-55
5 --------- 56 or older

45. Race

1 --------- White
2 --------- Hispanic
3 --------- Native American Indian
4 --------- Asian or pacific Islander
5 --------- Black
6 --------- Other_____

46. Sex

1 --------- Male
2 --------- Female

47. Job Title

1 --------- Machine operator
2 --------- Transfer line Machine operator
3 --------- Job setter or set up man
4 --------- Manufacturing technician
5 --------- Plumber of pipe fitter
6 --------- Other maintenance not listed_____

48. Years on present job,

1 --------- 0-5
2 --------- 6-10
3 --------- 11-15
4 --------- 16-20
5 --------- More than 20

49. Years at Ford.

1 -------- 0-5
2 -------- 6-10
3 -------- 11-15
4 -------- 16-20
5 -------- More than 20

50. What is the highest level of education you have attained?

1 -------- less than high school
2 -------- high school graduate
3 -------- trade school or some college
4 -------- college graduate ( bachelor's degree)
5 -------- post bachelor's degree

51. Have you attended safety training at Ford in the past?

1 -------- Yes
2 -------- No

52. What types of training methods were used in the programs you attended? (Check all that apply)

53 -------- Group sessions with an instructor
54 -------- Group sessions with an instructor using videotape or slides with tape recorded instruction
55 -------- interactive video or training using or controlled by a computer that leads you through the instruction
56 -------- Workbook self instruction

57. What types of training method you liked best?

1 -------- Group sessions with an instructor
2 -------- Group sessions with an instructor using videotape or slides with tape recorded instruction
3 -------- interactive video or training using or controlled by a computer that leads you through the instruction
4 -------- Workbook self instruction

58. What types of training method you like least?

1 -------- Group sessions with an instructor
2 -------- Group sessions with an instructor using videotape or slides with tape recorded instruction
3 -------- interactive video or training using or controlled by a computer that leads you through the instruction
4 -------- Workbook self instruction

In general, how do you feel about the safety training you've had?

59. ——— Found information useful
60. ——— Enjoyed the programs
61. ——— Would go to more if possible
62. ——— Information not of much use to me
63. ——— Waste of my time
64. ——— Prefer not to attend any more safety training programs

65. Have you attended any energy control and power lockout training before?

1 ——— Yes
2 ——— No

66. When you were in school, how would you describe yourself as a student?

1 ——— above average student
2 ——— good student
3 ———average student
4 ——— less than average student

67. Have you ever been involved in an industrial accident or known someone involved in an industrial accident?

1 ——— Yes
2 ——— No

68. Overall, how good a job do you feel your supervisor does?

1 ——— Very good
2 ——— Good
3 ——— Fair
4 ——— Poor
5 ——— Very poor

69. How would you rate the quality of work done in your work group.

1 ——— Very good
2 ——— Good
3 ——— Fair
4 ——— Poor
5 ——— Very poor

70. I like the kind of work I do.
1 ——— Strongly agree
2 ——— Agree
3 ——— Neither agree nor disagree
4 ——— Disagree
5 ——— Strongly disagree

71. The people I work with cooperate to get the job done.

1 --------- Strongly agree
2 --------- Agree
3 --------- Neither agree nor disagree
4 --------- Disagree
5 --------- Strongly disagree

72. Conditions in my job allow me to be as productive as I can be.

1 --------- Strongly agree
2 --------- Agree
3 --------- Neither agree nor disagree
4 --------- Disagree
5 --------- Strongly disagree

73. I feel encouraged to come up with new and better ways of doing things.

1 --------- Strongly agree
2 --------- Agree
3 --------- Neither agree nor disagree
4 --------- Disagree
5 --------- Strongly disagree

74. Considering every thing how satisfied are you with your job?

1 --------- Very satisfied
2 --------- Satisfied
3 --------- Neither satisfied nor dissatisfied
4 --------- Dissatisfied
5 --------- Very dissatisfied

75. How satisfied are you with your physical working conditions.?

1 --------- Very satisfied
2 --------- Satisfied
3 --------- Neither satisfied nor dissatisfied
4 --------- Dissatisfied
5 --------- Very dissatisfied

76. Considering everything, how would you rate your overall satisfaction with Ford at present time?

1 --------- Very satisfied
2 --------- Satisfied
3 --------- Neither satisfied nor dissatisfied
4 --------- Dissatisfied
5 --------- Very dissatisfied

77. How satisfied are you with your involvement in immediate decisions that effect your work?

1 ——— Very satisfied
2 ——— Satisfied
3 ——— Neither satisfied nor dissatisfied
4 ——— Dissatisfied
5 ——— Very dissatisfied

78. Would you be willing to participate in a telephone survey about the things asked you in this questionnaire and about the energy control and power lockout training program?

1 ——— Yes
2 ——— No

**Energy Control And Power Lockout**
**Interactive Video Training Survey For Trainees**

Place a check on the line next to the number of the responses that best describes how you feel about what has been said in the question.

1. My plant, management and the Union support job safety.

   1 --------- Strongly agree
   2 --------- Agree
   3 --------- Neither agree nor disagree
   4 --------- Disagree
   5 --------- Strongly disagree

2. The safety risks of my job, concerns me quite a bit.

   1 --------- Strongly agree
   2 --------- Agree
   3 --------- Neither agree nor disagree
   4 --------- Disagree
   5 --------- Strongly disagree

3. In my plant, workers who do not follow good safety practices irritate their fellow workers even when no one gets hurt.

   1 --------- Strongly agree
   2 --------- Agree
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4. Supervisors in my plant appreciate it when I tell them about safety hazards, and they try to get them corrected quickly.

   1 --------- Very satisfied
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   5 --------- Very dissatisfied

5. Our plant manager is well informed about safety issues in our plant.

   1 --------- Strongly agree
   2 --------- Agree
   3 --------- Neither agree nor disagree
   4 --------- Disagree
   5 --------- Strongly disagree
   0 --------- I don't have enough information to answer this question

6. I have the authority and the responsibility to lockout an operation before I work on it.

   1 --------- Strongly agree
   2 --------- Agree
   3 --------- Neither agree nor disagree
   4 --------- Disagree
   5 --------- Strongly disagree

7. Operations and equipment on my plant have been designed so that they can be easily locked out.

   1 --------- Strongly agree
   2 --------- Agree
   3 --------- Neither agree nor disagree
   4 --------- Disagree
   5 --------- Strongly disagree

8. If I choose not to lock out operations, machines or equipment before I work on them, I will be held accountable for my decision.

   1 ---------- Strongly agree
   2 ---------- Agree
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   5 ---------- Strongly disagree

9. Working safely is the number 1 priority in my plant.

   1 ---------- Strongly agree
   2 ---------- Agree
   3 ---------- Neither agree nor disagree
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10. It is not a common practice in my plant to defeat safety interlocks.

    1 --------- Strongly agree
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    5 --------- Hardly ever

16. Before starting a job, how often do you consciously evaluate the consequences of not doing the job safely?

    1 --------- Always
    2 --------- More often than not
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    4 --------- Occasionally
    5 --------- Hardly ever

17. How often, because of the pressure to get the job back in operation, do you not lockout or control power and energy:

    1 --------- Always
    2 --------- More often than not
    3 --------- Some times
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18. In the last month, before I worked on a machine, operation, or equipment I locked out power and control energy:

    1 --------- Always
    2 --------- More often than not
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    4 --------- Occasionally
    5 --------- Hardly ever

19. When is it OK to loan your lock to a fellow worker?

    1 --------- Never
    2 --------- Occasionally
    3 --------- Some times
    4 --------- More than not
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20. How often does a worker in your plant not lockout all sources of power and energy because he or she does not have enough locks?

    1 --------- Never
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    4 --------- More than not
    5 --------- Always

21. In your work assignments, how often is it impossible to lockout or control all sources of power and energy?

    1 --------- Never
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    4 --------- More than not
    5 --------- Always

Place a check on the line next to the number of the response that is the best answer to the following questions.

22. As soon as you have decided to lockout you should first:

    1 --------- Do it immediately
    2 --------- Communicate with the necessary personnel
    3 --------- Prepare the area

23. Preparing the area for lockout means:

    1 --------- Checking the hazards
    2 --------- Doing something about the hazards
    3 --------- Both of the above

24. Before locking out a specific machine, it is important to decide whether adjacent machinery requires lockout too.

    1 --------- True
    2 --------- False

25. Once you have worked on a piece of machinery a few times and know it well, you can assume you can lock it out safely.

    1 --------- True
    2 --------- False

26. Once you know the principles of lockout, you should be able to lockout any machine.

    1 --------- True
    2 --------- False

27. Effectively locking out a machine fed be multiple energies often requires that you use more than one lock.

    1 --------- True
    2 --------- False

28. In locking out, air, oil, water, steam, or gas under pressure:

    1 --------- Must be dissipated
    2 --------- Must be released

29. Which of the following a re proper disconnect points for a pneumatic system?

    1 --------- Piston valve
    2 --------- Handle / Lever valve
    3 --------- Gate valve
    4 --------- All of the above

30. Which of the following are the acceptable electrical disconnects.

    1 --------- On-off button
    2 --------- Selector switch
    3 --------- Toggle switch
    4 --------- Manually operated disconnect switch
    which can be locked in the off position

31. Stored energy cannot always be locked out.

    1 --------- True
    2 --------- False

32. Mechanical motion must be :

    1 --------- Controlled
    2 --------- Dissipated

33. Gravity must be:

    1 --------- Controlled
    2 --------- Dissipated

34. Stored mechanical energy in springs may be controlled or dissipated.

    1 --------- True
    2 --------- False

35. Safety blocks are built to withstand the force of the cycling machinery for which they are built.

    1 --------- True
    2 --------- False

36. When releasing hydraulic pressure, it is sometimes necessary to check, or to have qualified person check, that the pressure has been released by breaking a line at a fitting.

    1 --------- True
    2 --------- False

37. When making sure that pneumatic energy is absent, pressure gauges alone are enough to tell you that the pneumatic energy is absent.

    1 --------- True
    2 --------- False

38. When working in a team you should make sure that each person has placed a safety lock on each appropriate disconnect.

    1 --------- True
    2 --------- False

39. If you have to leave a job site after controlling and locking out power and energy and making sure that power and energy are absent, then as soon as you return to the job you should:

    1 --------- Continue work
    2 --------- Again make sure power and energy are controlled or locked out

40. When pulling electrical disconnect switches you should:

    1 --------- Face away from the panel box or cabinet
    2 --------- Face the panel box or cabinet

41. If you intend to work in a confined space that has a carbondioxide fire extinguishing system, you should lock the system out before entering the confined space.

    1 --------- True
    2 --------- False

42. Whenever you need to lockout, all you should concern yourself with is locking out the machine on which you are working.

    1 --------- True
    2 --------- False

43. It is your responsibility to make sure that the safety guards you removed during your work are put back properly after your work is done.

    1 --------- True
    2 --------- False

Question numbers 44 through 48 pertained to Computer interests of the participant

## ECPL Evaluation survey Background Information

Fill in the blanks or place a check mark next to the responses that best describes you or how you feel about what has been said in the question asked.

49. Your age is

1 --------- Less than 25
2 --------- 25-35
3 --------- 36-45
4 --------- 46-55
5 --------- 56 or older

50. Gender

1 --------- Male
2 --------- Female

51. Job Title

1 --------- Machine operator
2 --------- Transfer line Machine operator
3 --------- Job setter or set up man
4 --------- Manufacturing technician
5 --------- Plumber of pipe fitter
6 --------- Other maintenance not listed
7 --------- Electrician
8 --------- Millwright
9 --------- Machine repair
10--------- Cleaner
11--------- Supervisor
12 --------- Other

52. Years on present job.

1 --------- 0-5
2 --------- 6-10
3 --------- 11-15
4 --------- 16-20
5 --------- More than 20

53. Years at Ford.,

1 --------- 0-5
2 --------- 6-10
3 --------- 11-15
4 --------- 16-20
5 --------- More than 20

54. What is the highest level of education you have attained?

1 --------- less than high school
2 --------- high school graduate
3 --------- trade school or some college
4 --------- college graduate ( bachelor's degree)
5 --------- post bachelor's degree

55. How many training programs have you attended in the past?

1 --------- None
2 --------- 1
3 --------- 2
4 --------- 3-4
5 --------- 5-6
6 --------- 7 or more

56. In the training programs I have attended in the past, I enjoyed learning by group, lecture and discussion

1 --------- Strongly agree
2 --------- Agree
3 --------- Neither agree nor disagree
4 --------- Disagree
5 --------- Strongly disagree

57. In the training programs I have attended in the past, I enjoyed learning in a group, session with an instructor using videotape.

1 --------- Strongly agree
2 --------- Agree
3 --------- Neither agree nor disagree
4 --------- Disagree
5 --------- Strongly disagree

58. In the training programs I have attended in the past, I enjoyed learning by myself from instruction controlled by computer with video.

1 --------- Strongly agree
2 --------- Agree
3 --------- Neither agree nor disagree
4 --------- Disagree
5 --------- Strongly disagree

59. In the training programs I have attended in the past, I enjoyed learning by myself from instruction controlled by computer without video.

1 ——— Strongly agree
2 ——— Agree
3 ——— Neither agree nor disagree
4 ——— Disagree
5 ——— Strongly disagree

60. In the training programs I have attended in the past, I enjoyed learning from self-instruction workbook.

1 ——— Strongly agree
2 ——— Agree
3 ——— Neither agree nor disagree
4 ——— Disagree
5 ——— Strongly disagree

61. What types of training method you liked best?

1 ——— Group sessions with an instructor
2 ——— Group sessions with an instructor using videotape or slides with tape recorded instruction
3 ——— interactive video or training using or controlled by a computer that leads you through the instruction
4 ——— Workbook self instruction

62. What types of training method you like least?

1 ——— Group sessions with an instructor
2 ——— Group sessions with an instructor using videotape or slides with tape recorded instruction
3 ——— interactive video or training using or controlled by a computer that leads you through the instruction
4 ——— Workbook self instruction

63. I found the information in the past training programs useful.

1 ——— Strongly agree
2 ——— Agree
3 ——— Neither agree nor disagree
4 ——— Disagree
5 ——— Strongly disagree
0 ——— I have not attended any training programs in the past

64. I enjoyed the past training programs I have attended.

1 --------- Strongly agree
2 --------- Agree
3 --------- Neither agree nor disagree
4 --------- Disagree
5 --------- Strongly disagree
0 --------- I have not attended any training programs in the past

65. I would voluntarily go to more training programs if possible.

1 --------- Strongly agree
2 --------- Agree
3 --------- Neither agree nor disagree
4 --------- Disagree
5 --------- Strongly disagree
0 --------- I have not attended any training programs in the past

66. Have you attended any energy control and power lockout training before?

1 --------- Yes
2 --------- No

67. When you were in school, how would you describe yourself as a student?

1 --------- above average student
2 --------- good student
3 ---------average student
4 --------- less than average student

68. What experience have you had with industrial accidents?

1 --------- None
2 --------- I have had no accidents but have known someone involved in an accident
3 --------- I was involved in a minor accident
2 --------- I was involved in a serious accident

69. Overall, how good a job do you feel your supervisor does?

1 --------- Very good
2 --------- Good
3 --------- Fair
4 --------- Poor
5 --------- Very poor

70. How would you rate the quality of work done in your work group.

1 --------- Very good
2 --------- Good
3 --------- Fair
4 --------- Poor
5 --------- Very poor

71. I like the kind of work I do.

1 --------- Strongly agree
2 --------- Agree
3 --------- Neither agree nor disagree
4 --------- Disagree
5 --------- Strongly disagree

72. The people I work with cooperate to get the job done.

1 --------- Strongly agree
2 --------- Agree
3 --------- Neither agree nor disagree
4 --------- Disagree
5 --------- Strongly disagree

73. Conditions in my job allow me to be as productive as I can be.

1 --------- Strongly agree
2 --------- Agree
3 --------- Neither agree nor disagree
4 --------- Disagree
5 --------- Strongly disagree

74. I feel encouraged to come up with new and better ways of doing things.

1 --------- Strongly agree
2 --------- Agree
3 --------- Neither agree nor disagree
4 --------- Disagree
5 --------- Strongly disagree

75. Considering every thing how satisfied are you with your job?

1 --------- Very satisfied
2 --------- Satisfied
3 --------- Neither satisfied nor dissatisfied
4 --------- Dissatisfied
5 --------- Very dissatisfied

76. How satisfied are you with your physical working conditions.?

1 ——— Very satisfied
2 ——— Satisfied
3 ——— Neither satisfied nor dissatisfied
4 ——— Dissatisfied
5 ——— Very dissatisfied

77. Considering everything, how would you rate your overall satisfaction with Ford at present time?

1 ——— Very satisfied
2 ——— Satisfied
3 ——— Neither satisfied nor dissatisfied
4 ——— Dissatisfied
5 ——— Very dissatisfied

78. How satisfied are you with your involvement in immediate decisions that effect your work?

1 ——— Very satisfied
2 ——— Satisfied
3 ——— Neither satisfied nor dissatisfied
4 ——— Dissatisfied
5 ——— Very dissatisfied

Questions 79 - 113 were computer related questions

114. Would you be willing to participate in a telephone survey about the things asked you in this questionnaire and about the energy control and power lockout training program?

1 ——— Yes
2 ——— No

Appendix (B)

## MAYFLOWER ITEM STATUS

| ITEM | STATUS |
|---|---|
| 1. Overall, how good a job do you Feel is being done by your immediate manager / supervisor?<br>1 = Very good<br>2 = Good<br>3 = Fair<br>4 = Poor<br>5 = Very Poor | Original Core Item. |
| 2. There is no current Mayflower item 2. | |
| 3. I like the kind of work I do.<br>1 = Strongly agree<br>2 = Agree<br>3 = Neither agree nor disagree<br>4 = Disagree<br>5 = Strongly disagree | Original Core Item. |
| 4. Considering every thing, how satisfied are you with your job?<br>1 = Very satisfied<br>2 = Satisfied<br>3 = Neither satisfied nor dissatisfied<br>4 = Dissatisfied<br>5 = Very dissatisfied | Original Core Item. |
| 5. My job makes good use of my skills and abilities.<br>1 = Strongly agree<br>2 = Agree<br>3 = Neither agree nor disagree<br>4 = Disagree<br>5 = Strongly disagree | Original Core Item. |
| 6. The people I work with cooperate to get the job done.<br>1 = Strongly agree<br>2 = Agree<br>3 = Neither agree nor disagree<br>4 = Disagree<br>5 = Strongly disagree | Original Core Item. |
| 7. How do you rate the amount of pay you get on your job?<br>1 = Very good<br>2 = Good<br>3 = Fair<br>4 = Poor<br>5 = Very Poor | Original Core Item. |

8. In comparison with people in similar jobs in other companies, I feel my pay is: — Original Core Item.

   1 = Much higher
   2 = Slightly higher
   3 = About the same
   4 = Slightly lower
   5 = Much lower

9. How do you rate your total benefits program (Insurance, Medical etc.)? — Original Core Item.

   1 = Very good
   2 = Good
   3 = Fair
   4 = Poor
   5 = Very Poor

10. How do you rate this company in providing job security for people like yourself? — Original Core Item.

    1 = Very good
    2 = Good
    3 = Fair
    4 = Poor
    5 = Very Poor

11. How satisfied are you with your opportunity to get a better job in this company? — Original Core Item.

    1 = Very satisfied
    2 = Satisfied
    3 = Neither satisfied nor dissatisfied
    4 = Dissatisfied
    5 = Very dissatisfied

12. How satisfied are you with the information you receive from management on what's going on in the company? — Original Core Item.

    1 = Very satisfied
    2 = Satisfied
    3 = Neither satisfied nor dissatisfied
    4 = Dissatisfied
    5 = Very dissatisfied

13. I have enough information to do my job well. — Original Core Item.

    1 = Strongly agree
    2 = Agree
    3 = Neither agree nor disagree
    4 = Disagree
    5 = Strongly disagree

14. Sufficient effort is made to get the opinions and thinking of people who work here.

    1 = Strongly agree
    2 = Agree
    3 = Neither agree nor disagree
    4 = Disagree
    5 = Strongly disagree

15. How satisfied are you with the training you received for your present job?

    1 = Very satisfied
    2 = Satisfied
    3 = Neither satisfied nor dissatisfied
    4 = Dissatisfied
    5 = Very dissatisfied

16. I am given a real opportunity to improve my skills in this company.

    1 = Strongly agree
    2 = Agree
    3 = Neither agree nor disagree
    4 = Disagree
    5 = Strongly disagree

17. Considering everything, how would you rate your overall satisfaction in your company at the present time?

    1 = Very satisfied
    2 = Satisfied
    3 = Neither satisfied nor dissatisfied
    4 = Dissatisfied
    5 = Very dissatisfied

18. My work gives me a feeling of personal accomplishment.

    1 = Strongly agree
    2 = Agree
    3 = Neither agree nor disagree
    4 = Disagree
    5 = Strongly disagree

19. There is no current Mayflower item 19.
20. There is no current Mayflower item 20.
21. There is no current Mayflower item 21.
22. There is no current Mayflower item 22.
23. There is no current Mayflower item 23.
24. There is no current Mayflower item 24.

25. How satisfied are you with the recognition you receive for doing a good job?

    1 = Very satisfied
    2 = Satisfied
    3 = Neither satisfied nor dissatisfied
    4 = Dissatisfied
    5 = Very dissatisfied

26. How satisfied are you with your involvement in decisions that affect your work?

1 = Very satisfied
2 = Satisfied
3 = Neither satisfied nor dissatisfied
4 = Dissatisfied
5 = Very dissatisfied

27. (Company Name) is making the changes necessary to compete effectively.

1 = Strongly agree
2 = Agree
3 = Neither agree nor disagree
4 = Disagree
5 = Strongly disagree

28. Conditions in my job allow me to be about as productive as I could be.

1 = Strongly agree
2 = Agree
3 = Neither agree nor disagree
4 = Disagree
5 = Strongly disagree

29. How would your rate the overall quality of work done in your work group?

1 = Very good
2 = Good
3 = Fair
4 = Poor
5 = Very Poor

30. The amount of work I am expected to do on my job is:

1 = Far too much
2 = Too much
3 = About right
4 = Too little
5 = Far too little

31. How satisfied are you with your physical working conditions?

1 = Very satisfied
2 = Satisfied
3 = Neither satisfied nor dissatisfied
4 = Dissatisfied
5 = Very dissatisfied

32. I feel encouraged to come up with new and better ways of doing things.

1 = Strongly agree
2 = Agree
3 = Neither agree nor disagree
4 = Disagree
5 = Strongly disagree

33. How would you rate(Company Name) as a company to work for compared to other companies?

1 = One of the best
2 = Above average
3 = Average
4 = Below average
5 = One of the worst

Appendix (C)

The no Significant Difference Phenomenon
as reported in summaries and papers has been compiled by

Thomas L. Russell

North Carolina State University

## No significant difference studies

| Year | Author | Title & Type of work | Quote |
|---|---|---|---|
| 1928 | Crump, R.E. | Correspondence and Class Extension Work in Oklahoma Doctoral Dissertation Teachers College, Columbia University | " no differences in test scores of college classroom and correspondence study students enrolled in the same subjects " |
| 1936 | Sorenson, H. | Comparative Abilities of Extension and Non-Extension Students Twenty-third Annual Meeting Association of Urban Universities 54-60 | "[Results of this study were very similar to Crump 1928 and showed] no differences in test scores of college classroom and correspondence study students enrolled in the same subjects " |
| 1937 | Loder, J. E. | A Study of Aural Learning With and Without the Speaker Present Master's Thesis University of Nebraska, Lincoln, Nebraska | One group saw the speaker; and the other group heard him from another room [on a loud speaker]. The direct group performed better; but later tests showed that the means were not significantly different |
| 1940 | Hanna, L.N | Achievement of High School Students in Supervised Correspondence Study Master's Thesis University of Nebraska | " In all but two comparisons, correspondence study students performed as well as or better than their classroom counterparts and in the two cases which were the exception the differences were not significant " |
| 1943 | Rulon, P. V | A Comparison of Phonographic Recordings with Printed Motivation to Further Study The Harvard Educational Review 8 246-55 | Showed no significant differences between the groups in terms of motivation to use supplementary reading material " |
| 1945 | Woelfel, N and Tyler, I K. | Radio and the School World Book Tarrytown-on-Hudson, N Y | "The results of the study yielded no significant difference between the reading and listening groups The most significant finding the radio group did equally well as compared to the standard reading group [also] reviewed several research studies that were designed to compare the effectiveness of instructional radio with traditional methods no significant difference in achievement resulted from the majority of studies reviewed " |
| 1946 | Meierhenry, W C | A Vocational Education Program for the Small High School Utilized Correspondence Study and Work Experience - Doctoral Dissertation University of Nebraska, Lincoln, Nebraska | [Results of this study were similar to Hanna (1940) and showed ] in all but two comparisons, correspondence study students performed as well or better than their classroom counterparts and in two cases, which were the exceptions, the differences were not significant |
| 1946 | Meierhenry, W C | Relative Effectiveness of Instruction of Films Exclusively, Films Plus Study Guides, and Standard Lecture Methods (technical report no SDC 269-7-130) Port Washington - U S Naval Training Devices Center - New York, New York | Compared ninth-grade biology students taught by (1) sound films, (2) sound films plus study guides, and (3) standard lecture demonstration classroom instruction No significant differences were found across all groups on either immediate of month-delayed achievement testing |
| 1949 | Scott, G | A Study of the Contribution of Motion Pictures to the Educational Achievement in Nebraska High Schools University of Nebraska, Lincoln | " the difference in scores between the two groups was significantly less when standardized tests were used as measures of achievement " |
| 1950 | VanderMeer, A. W | Relative Effectiveness of Instruction by Films Exclusively, Films Plus Study Guides, and Standard Lecture Methods Technical Report No. SDC 269-7-130 U. S. Navy Training Devices Center - Port Washington | .. compared ninth-grade biology students taught by: (1) sound films, (2) sound films plus study guides, and (3) standard lecture demonstration classroom instruction No significant differences were found across all groups on either immediate or month-delayed achievement testing |
| 1952 | Stromberg, E. L. | College for Television Home Study American Psychologist 7 507-509 | "The author concludes that open-circuit TV is an effective means of reaching college credit students in their homes " |
| 1953 | Brushwood, J and Polmantier, P | The Effectiveness of the Audio-Laboratory in Elementary Modern Language Courses University of Missouri, Columbia, Missouri | The results showed that there were no significant differences on the cooperative measures |
| 1954 | Kanner, J. H., Runyon, R. P., & Desiderato, O | Television in Army Training: Evaluation of Television in Army Basic Training George Washington University | "In five of 17 tests given, the TV group scored significantly higher In the remaining 12 tests no significant differences were found " |
| 1955 | Carpenter, C. R. Greenhill, L. P | An Investigation of Closed-Circuit Television for Teaching University Courses Instructional Television Research, Project Number One Pennsylvania State University | "The difference between the effectiveness of televised instruction versus conventional instruction was not statistically significant " |

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|---|---|---|---|
| 1956 | Kumata, H | An inventory of Instructional Television Research University of Michigan | " the effects of television as a variable operating in a field of perhaps hundreds of other potential variables is of minor significance Therefore, no significant differences in results are to be expected " |
| 1957 | Parsons, T. S. | A Comparison of Instruction by Kinescope, Correspondence Study and Customary Classroom Procedures, Journal of Educational Psychology, 48: 27-40 | " compared instruction by kinescope, correspondence study, and classroom procedures in a course in child development and found no advantage for any one procedure " |
| 1958 | Carpenter, C. R. & Greenhill, L. P | An Investigation of Closed Circuit Television for Teaching University Courses Instructional Television Research, Report Number Two Pennsylvania State University | " studies of the comparative effectiveness of conventional and televised instruction, even though carefully designed to control variables yielded non-significant differences in student's achievement scores " |
| 1959 | Driscoll, J. P | Can TV Improve College Teaching? Journal 18 NAEB | " no significant difference between groups on the final examination no significant difference between groups on the course content test gains no significant difference in the test performance " |
| 1960 | Starlin, G. & Lallas, J. E. | Inter-institutional Teaching by Television in the Oregon State Systems of Higher Education Report No 1 1957-59 Oregon State System of Higher Education | "School in American life- no significant differences on final examination scores Human development- no significant differences for any of the three examinations between face-to-face and ITV students Chemistry- no differences in the final examinations Educational psychology- An analysis of variance on final examination scores between face-to-face and ITV students indicated no significant differences " |
| 1961 | Starlin, G. & Lallas, J. E. | Inter-institutional Teaching by Television in the Oregon State System of Higher Education Oregon State System of Higher Education Report No 2 1959-61 Oregon State System of Higher Education | "From the 6 years of study the authors concluded that students on all campuses learned equally well when taught by television from one campus Students also learned as well when taught by television as when taught by face-to-face methods " |
| 1962 | Schramm, W | What We Know About Learning from Instructional Television The Next Ten Years Stanford Institute for Communication Research | " the results of 393 studies were summarized Of these, 83 showed differences in learning in favor of television, 255 reported no significant differences, and 55 favored direct classroom teaching There can no longer be any doubt that students learn efficiently from instruction television The fact has been demonstrated now in hundreds of schools, by thousands of students, in every part of the United States and in several other countries Instruction Television is at least as effective as ordinary classroom instruction, when the results are measured by the usual final examinations or by standardized tests employing the usual tests that schools use we can say with considerable confidence that in 65 percent of a very large number of comparisons between televised and classroom teaching, there is no significant difference In 21 percent, students learned significantly more, in 14 percent, they learned significantly less, from television " |
| 1963 | Castle, C. H. | Open-circuit Television in Postgraduate Medical Education Journal of Medical Education 38 254-260 | " open-circuit television can be used in postgraduate medical education without undesirable effects " |
| 1963 | Skinner, T. B | An Experimental Study of the Effects of Prestige & Delivery Skill in Educational Television University of Michigan, Ann Arbor | " no main effect for the prestige variable A supplemental experiment indicated no significant differences between the two perceived prestige images " |
| 1964 | Greene, H. | Current Status of the Texas Educational Microwave Project NAEB National Conference Proceedings | "TEMP courses are as effective as face-to-face teaching Even faculty members who may have objections to television for other reasons acknowledge this " |

| | | | |
|---|---|---|---|
| 1965 | Razik, T. A. | What Instructional Television Research Tells Us. State University of New York at Buffalo | " students taught by television learned content as well as or better than those taught without it. judged equal in the teaching of elementary music. found the TV group of medical school students superior, but not significantly so." |
| 1966 | Skornia, H. J. | What We Know from New Media Research. NAEB | "Oregon reported students learning as well. The Hagerstown experiment reported that in no subject did TV fail to produce results at least as good as those achieved when classroom instruction alone was used." |
| 1967 | Chu, C. & Schramm, W. | Learning from Television. Stanford University | "Of the 421 separate comparisons made 308 showed no significant differences, 63 showed television instruction to be superior, and 50 found conventional instruction better. In a total of 202 comparisons of television and conventional teaching at the college level, 152 showed no significant difference in student performance, 22 showed television to be more effective, and 28 showed conventional teaching to be more effective." |
| 1968 | Thornton, J. W. and Brown, J. D. | Department of Audiovisual Instruction. NEA. Department of Audiovisual Instruction | "There is no longer any question as to the efficacy of television in extending and improving instruction in higher education. In nearly every situation where it has been tried and carefully evaluated, results show that it permits learning equal to and not rarely superior to that achieved under traditional classroom practices." |
| 1969 | Davis, R., Johnson, C., Dietrich, J. | Students Attitudes, Motivations Shown to Influence Reception to Televised Lectures. College and University Business, Vol. 46, No. 5, 59-63 | "The overall distribution of grades for students who saw lectures live was not significantly different from students who saw lectures on TV." |
| 1970 | Forsythe, R. | Instructional Radio: An Evaluation of Instructional Technology. Instructional Technology | "Experimental studies comparing radio teaching with other means or media have found radio as effective as the so-called conventional methods. Even though radio has been criticized for being only an audio medium, studies have shown that visual elements in learning are not uniformly important." |
| 1971 | Johnson, L. | Cable Television and Higher Education: Two Contrasting Experiences. ERIC | " students can learn about as well from television as from classroom instruction." |
| 1972 | Schram, W. | Quality in Instructional Television: What Research Says About ITV. University Press of Hawaii | "Students like a 'talkback' system, but seem to learn no more with it than without it. No learning advantage has been demonstrated for 'professional' or 'artistic' production techniques." |
| 1973 | Lang, M. T. | Computer Extended Instruction in Introductory Calculus. Dissertation Abstracts International 34 University Microfilm Abstracts No. 74-5, 271 p. 5662A | "CAI has the potential to be an effective means of improving the students understanding of the basic concepts of calculus. No statistical significance was found for achievement." |
| 1974 | Thorman, J. H. & Amb, T. | The Video Tape Presentation versus the 'Live' Presentation: Better, Worse or the Same? Moorhead State College | " the students learned the same amount, as measured by test performance, whether they were taught by the videotape-discussion method or by the lecture-discussion method." |
| 1975 | Chu, G. & Schramm, W. | Learning From Television: What the Research Says. ERIC ED 109, 985 | " an experimental study with 80 college students to test the effect of feedback on learning. No difference was found in learning and retention among four treatments. There can no longer be any real doubt that children and adults learn a great amount from instructional television. The effectiveness of television has now been demonstrated in many parts of the world, in developing as well as industrialized countries, at every level from pre-school through adult education, and with a great variety of subject matter and methods. No difference was found in learning and retention." |

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|---|---|---|---|
| 1976 | Gordon, G. N. | Classroom Television: New Frontiers in ITV-Research and the Wonder Drug: NSD Communication Arts Books Hastings House | "The kind of research that characterizes most of the documents purporting to examine ITV show no significant difference between courses taught over television and equivalent courses given to live matched groups." |
| 1977 | Saloman, G. & Clark, R. E. | Reexamining the Methodology of Research on Media & Technology in Education Review of Educational Research | "Studies have consistently reported achievement on performance tests was similar regardless of the medium used media (face-to-face versus television) were not significant factors on achievement." |
| 1979 | Orlansky, S. and String, J. | Cost-Effectiveness of Computer-Based Education in Military Training IDA paper Science, and Technical Division, Institute for Defence Analysis, Arlington, VA | "overall difference in achievement had no practical significance because no significant difference in achievement was found in thirty-two studies." |
| 1980 | Wilkenson, G. L. | Media in Instruction: 60 Years of Research AECT & NAVA | "The results of several decades of research can be summed up as 'no significant difference'." |
| 1981 | Cohen, P., Ebeling, B. & Kulik, J. | A Meta-Analysis of Outcome Studies of Visual-based Instruction Educational Communications and Technology Journal | "students learned slightly more from visual-based instruction than from traditional teaching, but there was typically no difference between the two groups in regard to course completion, student attitudes, or the correlation between attitudes and achievement." |
| 1982 | Montgomerie, T. C. | Telidon Distance Education Field Trial Telidon Project Evaluation, Alberta, Canada, Department of Education, Planning and Research Branch, November 207 | "Telidon instruction was as effective as the traditional correspondence and conventional in-school instruction." |
| 1983 | Clark, R. E. | Reconsidering Research on Learning from Media University of Southern California | "there are no learning benefits to be gained from employing any specific medium to deliver instruction. The best current evidence is that media are mere vehicles that deliver instruction but do not influence student achievements any more than the truck that delivers our groceries causes changes in our nutrition." |
| 1984 | Weingand, D. E. | Telecommunications and the Traditional Classroom A Study of the Delivery of Education University of Wisconsin | "1) there is no evidence to support the idea that face-to-face instruction is the optimum delivery method, 2) Instruct-ion by teleconferencing can facilitate learning as well as or better than can classroom instruction, and 3) the absence of face-to-face contact is not detrimental to the learning process." |
| 1985 | Robinson, R. S., Collins, K. M. & West, P. C. | Share Advanced [Secondary] Courses With Other Schools via Interactive Cable Television Northern Illinois University | "Students in interactive-television classes achieved as well on the post-test as did students in 'live' classrooms." |
| 1987 | Whittington, N. | Is Instructional Television Educationally Effective? A Research Review The American Journal of Distance Education, 1 47-57 | "a three-year study which compared the performance of full-time Stanford students and students obtaining instruction via the live, interactive ITFS system 16,652 students taking traditional, on-campus instruction scored a mean GPA of 3.40, while 1,771 students taking live, interactive video instruction has a mean GPA of 3.39 In addition Stanford is using tutored video instruction Research indicates that this method also promoted equivalent student achievement." |
| 1988 | Annenberg/CPB Project | Teaching Telecourses: Opportunities and Options: How Do Telecourses Compare to Other Types of Courses? PBS Adult Learning Service | "television-delivered instruction is equivalent to traditional, classroom-based instruction in its learning effectiveness outcomes of the television courses are roughly equivalent to the outcomes of the comparable traditional courses. tele-course students performed better than or as well as non-telecourse students a third of the faculty studied reported that Annenberg/CPB courses retained more students than traditionally taught courses Another third said that retention was equal to traditionally taught courses." |

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|---|---|---|---|
| 1989 | Silvernail, D. L. & Johnson, J. L. | Evaluative Research Studies of the University of Southern Maine Instructional Television System University of Maine | ". no significant differences in the achievement or attitudes of students receiving live classroom instruction and those receiving some type of televised instruction. Overall, no significant differences were found in the achievement levels. no significant differences in end of course grades between ITV and non-ITV classes. no significant differences in grades between the origination site and remote sites. students do equally well in courses taught over the ITV system as they do in a traditional classroom setting Students learned course content generally well. Students receiving their course instruction by means of interactive television learned as well as students in a traditional classroom " |
| 1990 | Schmitt, D R. | Can CAI Be More Effective for Teaching Johnny than Traditional Instruction - Why Have Studies Been Inclusive? Proceedings. Annual Convention of the Association for Educational Communications and Technology, Anaheim, California 539-555 | meta-analyses have been performed which contend that CAI is at least not harmful and probably effective as the technology of computers grows and the demand for computers in schools from within the education profession and from parents increases, there needs to be accountability that CAI is useful, effective, and necessary Unless there are sound research studies to backup the use of CAI, it will fall like a dead duck " |
| 1991 | Gehlauf, D N., Shatz, M A. & Frye, T W | Faculty Perceptions of Interactive Instructional Strategies Implications for Training The American Journal of Distance Education, Vol 5, No 3 | "One of the first issues to be investigated was whether students were getting the same education in the technologically delivered classes as in the traditional classroom there are no significant differences in academic performance for students in the two settings " |
| 1992 | Smith, E. E. & Shen, C | The Effects of Knowledge of Results Feedback of Captioning on Listening Comprehension of English as a Second Language in Interactive Videodisc System Proceedings of Selected Research and Development Presentations at the AECT National Convention pp 718-742 | Based on the findings that no significant differences existed between the treatment groups on the TOEFL Listening Comprehension subtest, it was concluded that the captioning used as knowledge of results does not improve general listening comprehension skills |
| 1992 | Thompson, M E., Carl, D Hill, F | Channel One News in the Classroom Does It Make A Difference Proceedings National Convention of the Association for Educational Communications and Technology 813-817 | "The Exposure to news and current events via Channel One could also explain the student's tendency to answer more questions correctly on current events although this finding was not significant at the .05 level " |
| 1993 | Hudson, L. & Olmstead, P | Audio- and Computer-Conferencing: A Comparison Distance Education for the Twenty-First Century - Proceedings of the November 1992 ICDE Conference - Thailand 260-265 | Based upon this limited case study, it is evident that the use of COM TP [computer-conferencing] instead of audio conferencing for distance education does not affect the students' academic performance in the course |
| 1993 | Hudson, L., Dietzel R., Sandiford, J. & Morris, D | Effectiveness of Satellite Programs for Technical Updating of Vocational Education Teachers Journal of Health Occupations Education - Fall, Vol 8, No 2 | There were no significant differences between interactive and non-interactive sites " |
| 1994 | Lin,C. & Davidson, G. | Effects of Linking Structure and Cognitive Style on Students' Performance and Attitude in a Computer-Based Hypertext Environment Proceedings Selected Research and Development Presentations at the National Convention of the AECT Nashville, Tennessee 451-461 | There is no difference in subjects performance when learning from hypertext systems with different linking structures " |
| 1994 | Wilson, J M. | The CUPLE Physics Studio The Physics Teacher 32 No 9 | Students in these courses are performing as well or better than students in the traditional courses in spite of the 33.3% reduction in class contact time |

| | | | |
|---|---|---|---|
| 1995 | Barry, M. & Runyan, G. | A Review of Distance-Learning Studies in the U. S. Military The American Journal of Distance Education 9(3) 37-47 | "All studies in the table reported no significant differences between resident and distant groups. It appears from the studies reviewed here that student achievement in distance learning courses is comparable to student achievement in resident courses. Studies conducted in military settings tend to show no significant difference in achievement between distance learners and resident learners." |
| 1996 | Koob, B. | New Funding Paradigms: The Need for New Incentives NLI Viewpoint - Spring/Summer 33-35 | " no detectable loss of course success was found." |
| 1996 | "... no detectable loss of course success was found." | The Effectiveness of Traditional vs. Audiographics Delivery of Senior High Advanced Mathemance Courses Journal of Distance Education - Vol. 11, No. 2 45-55 | Results showed that distance education students were as successful in both achievement in senior high advanced mathematics and in success in postsecondary calculus courses as traditionally taught students |
| 1997 | Bates, A. W | Restructuring the University for Technological Change Proceedings: The Carnegie Foundation for the Advancement of Teaching What Kind of University? Conference - London, England | Many hundreds of thousands of such comparative studies have been made in the past, and the usual result when the comparisons have been done using sound research is that there is no significant difference." |
| 1997 | Goldberg, M. W | CALOS First Results From an Experiment in Computer-Aided Learning Proceedings of the ACM's 28th SIGCSE Technical Symposium on Computer Science Education 11 | "up of students in the WWW-only offering achieved roughly the same level of academic performance as did the group of students in the lecture-only offering. As one might expect, students with access to both sources on information achieved a higher level of performance." |
| 1997 | Jones, G. R | Cyberschools An Education Renaissance Jones Digital Century, Inc pp. 58 & 128 | Clearly, all mediums of communications have their advantages and disadvantages. But the research really does show there is no significant difference in the student's ability to learn using technology-based education tools. And not just for computer-aided teaching. Long ago research into whether television was an inferior learning tool proved there is no real difference between learning from TV and learning from the traditional classroom. It was reported time and again in research on how we learn at all levels that electronic instruction--either via teleconference or computer conference-- can be as effective as traditional classroom-based lectures and face-to-face discussion. On-line students have test scores equal to those in conventional classrooms |
| 1997 | Old Dominion University | Teletechnet--Old Dominion University and "Two Plus Two" Programs at Community Colleges in Virginia. A Case Study in Benefits and Costs of an Intercampus Instructional Television Network. Old Dominion University http://www.calstate.edu/special_projects/ - 5pp | Learning [was] deemed to be at least equivalent to on-campus instruction as indicated by comparisons of (a)course grades (regular classroom, TELETECHNET studio, TELETECHNET (b)receive site) (c)student performance on exit writing (d)examination (e)student evaluations of satisfaction with the programs ... The quality of the instruction provided via TELETECHNET is equivalent to that provided by on-campus classroom instruction |
| 1997 | Rensselaer Polytechnic Institute | A Case Study in the Benefits and Costs of a joint Industry/University Designed Program Featuring Integrated Delivery Methods Rensselaer Polytechnic Institute http://www.calstate.edu/special_projects/mediated_ | there was little variation among final grades for students enrolled in the three modes (studio site, videoconferencing sites, and videotape sites) no significant performance difference is noted between those who took the course on campus or at a distance, and for the distance learners, course delivery mode did not make a difference |

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| 1998 | --- | Course Restructuring and the Instructional development Initiative at Virginia Polytechnic Institute: A Benefit Cost Study Virginia Tech http //www calstate edu/special_projects/medi ated_ | .. [Philosophy Course] Students in the web-based course scored better than the lecture section on eight of the sixteen specific essay scoring criteria deemed important to the philosophical discourse, there was no significant difference between the two sections on seven of the criteria, and the lecture section scored significantly better on only one criteria. Even though the web-based group showed superior performance based upon the sixteen criteria, letter grades assigned by the readers to this particular essay showed no significant difference between the two groups " " [Microbiology Course] the evidence strongly suggests there is no difference in either mean grades of the grade distributions for the versions of the course offered before and after the course design |
| 1998 | Baruch College | Teaching College Literacy A Case Study in the Benefits and Costs of Daedalus courseware at Baruch College Baruch College http //www calstate edu/special_projects/ - 19pp | Seventy-five percent of the 16 students in the Dadaelus section of ENG 0160 passed the CUNY Writing Assessment Test This compares to a 53 percent pass rate for the 12 students in the control section The difference in the passing rate was not statistically significant the computer-enhanced instruction did not have a significant effect on improving retention The observed difference between the passing rates for the two courses in not statistically significant at either the one or five percent level |
| 1998 | Blackley, J A & Curran-Smith, J | Teaching Community Health Nursing by Distance Methods Development, Process, and Evaluation Journal of Continuing Education for Nurses - Jul-Aug, 29(4) 148-153 | Evaluation found students were able to meet their course objectives and perform as well as students who had completed a similar on-campus course |
| 1998 | Cleveland State University | The Master s Degress in Social Work at Cleveland State University and the University of Akron A Case Study of the Benefits and Costs of a Joint Degree Program Offered via Videoconferencing Cleveland State University http //www calstate edu/special_projects/medi ated_instr/Ohio/Ohio-Sum html | Comparisons were made of grade averages for students at sending and receive sites The t statistic was not significant (5 percent level) in any of the comparisons made There is no significant difference in learning outcomes, as measured by grades, for students at send or receive sites By implication there is no evidence of either a positive or negative effect due to the use of videoconferencing technology nor of grading bias on the part of instructors |
| 1998 | English, T, Harrison, A. L., & Hart, A. L | A Distance Learning Model in a Physical Therapy Curriculum The Journal of Allied Health - Fall-Winter, 27(4) 228-232 | Faculty at the University of Kentucky developed a distance education program that combined classroom lecture and discussion via compressed video technology with laboratory experiences for the patho-mechanics course For this particular course, there was no statistically significant difference in the outcome measures utilized to compare the distance learners with on-site learners |
| 1998 | Goldberg, D | Teaching Online - Education Review Washington Post, April 5 | And Jack Wilson, faculty dean at Rensselear Polytechnic Institute, where almost one-third of graduate students are taking courses at a distance, said the off-campus students perform just as well as their on-campus counterparts in the same courses " |
| 1998 | Knowles, E | Milestone Report for the project: Curriculum Design, Production, and Delivery of MEA200 as a World-Wide Web Course Part 3 North Carolina State University | "The project compares the performance of the students taking the same course in five other venues (regular class, summer term, and cable, video and written independent study) the mean total scores earned by students in all venues are quite comparable " |

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| 1998 | Koch, J V | How Women Actually Perform in Distance Education The Chronicle of Higher Education - September 11 p A60 | two studies of students in Indiana--one conducted at Ball State and the other at Indiana State university--found no statistically significant difference between male and female students in their satisfaction with distance-education courses The studies included more than two dozen courses and more than 400 students Old Dominion researchers asked 12,000 students in almost 150 distance-learning courses in 25 degree programs about their satisfaction with the courses found no significant differences between men and women the bottom line is that neither female nor male distance-learning students appear to learn less than students in traditional classes In fact, the evidence indicates the opposite |
| 1998 | Major, H | Learning Styles and distance Learning DEOS-L Listserve Posting | Student achievement was very high for some objectives and about the same as face-to-face courses I had taught |
| 1998 | McAlpin, V F | On-line and F2F Students Is there really any difference? Proceedings 2nd UNC Workshop on Technology for Distance Education North Carolina State University 6-7 | 'Data analysis revealed that delivery strategy does not influence the academic performance of on-line and F2F students ' |
| 1998 | Parks, E | Video Who Needs It? Online Learning News - Vol 1, No 10, June 5 | I then reworked the video into four treatments full-motion, animation, slide show (low motion), and still pictures (limited visual stimuli) Conventional wisdom was that the full-motion would be best But it turned out there was no difference in learning among the groups using each treatment ' |
| 1998 | The WESTNET Program | A Case Study in the Benefits and Costs of an Interactive Television Network The WESTNET Program http //www calstate edu/special_projects/ - 28pp | the proportion of students earning grades of 'A or B' at the sending and receive sites was not statistically significant at the 5 percent level The responses to the specific survey items where there were among the send and receive site students provide no indications unfavorable toward WESTNET |
| 1998 | University of Maine System | The Education Network of Maine A Case Study in the Benefits and Costs of Instructional Television University of Maine System http //www calstate edu/special_projects/ - 28pp | A statistically significant difference in average grades between broadcast and receive site students (in favor of the broadcast site students) was found in only one course Of the remaining 17 courses for which sufficient data were available to conduct a t test, the differences in average grades were not statistically significant There were no significant differences between the responses of the students in the live network and the videotaped version of the course Based upon these survey responses, there is no evidence that receive site students preferred the live network course over the videotape version of the same material |
| 1998 | Virginia Tech | Course Restructuring and the Instructional Development Initiative at Virginia Polytechnic Institute and State University: A Benfit Cost Study Virginia Tech http //www calstate edu/special_projects/medi ated_ | [ Philosophy course] Students in the web-based course scored better than the lecture section on eight of the sixteen specific essay scoring criteria deemed important to philosophical discourse, there was no significant difference between the two sections on seven of the criteria, and the lecture section scored significantly better on only one criterion Even though the web-based group showed superior performance based upon the sixteen criteria, letter grades assigned by the readers to this particular essay showed no significant difference between the two groups |

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| 1998 | Ward, J. | Community College Student Perceptions of Online Instruction Experiences Ed. Education at a Distance Vol. 12, No.. 3 6 | "Students were enthusiastic about this learning experience. believed Jackson's online course design was equally effective as traditional classroom instruction, and stated a high level of satisfaction overall." |
| 1998 | Wisher, R.A., & Priest, A.N. | Cost-effectiveness of Audio Teletraining for the US Army National Guard The American Journal of Distance Education, Vol. 12, No.1 38-51 | "...although it appeared that students learned more quickly in the distance learning format, in a course of fixed length (three weeks), where there was ample time for retraining and retesting, there was ultimately equal effectiveness between groups This analysis supports many previous reports that a distance learning group performed as well, if not better than, a resident control group" |
| 1999 | Ball, A. M. | Marketability of the Physical Therapist with an Advanced / Post-Professional Degree Earned through Distance Education MBA/PhD Dissertation - Publication in Progress University of North Carolina - Chapel Hill | Though gaps exist between on-site and distance education in the fields of Business / Healthcare Administration, Education, and Public Health / Public Policy, these gaps are negligible and equivocal between the three fields of study |
| 1999 | Clarke, D | Getting Results with Distance Education University of California @Santa Cruz Unpublished - Contact author at declark@ucscextension.edu.The American Journal of Distance Education, Vol. 12, No 1 38-51 | "There were no significant differences in the test scores for the classes measured same class, same instructor, same audience, same exam -- just different format" |
| 1999 | Dobrin, J | Who's Teaching Online ITPE News - Vol 2, Issue 12, June 22 6-7 | 85% of faculty felt that student learning outcomes in online education were comparable or better to those found in face-to-face classrooms While this was consistent with much of the data that exists in support of the No Significant Difference Phenomena, it was encouraging to see that so many faculty (with experience in teaching the same course in face-to-face and online environments) were in support of online courses being as effective as classroom courses" |
| 1999 | Dutton, J., Dutton, M., & Perry, J. | Do Online Students Perform As Well As Traditional Students? Submitted for publication North Carolina State University | These results demonstrate that online students can perform at least as well as traditional students They do not show that any student, randomly selected, can do as well in an online class Undoubtedly self-selection means that students with greater computer skills and/or greater maturity are more likely to opt for an online course However we have reduced the effects of those factors in this study The subject matter of the course reduces variability in computer skills in this case And in the empirical work we have controlled for maturity differences to the extent we could So our results provide support for further development of online course delivery |
| 1999 | Hoffman, K. M. | What Are Faculty Saying? eCollege.com - May | Faculty report that learning outcomes in online education are comparable to (62%) or better than (23%) those of face-to-face courses.. Eighty-five percent of faculty teaching online said their students learned equally effectively as on campus students and some said their students did even better |

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| 1999 | Navarro, P & Shoemaker, J. | The Power of Cyberlearning: An Empirical Test Journal of Computing in Higher Education | The findings appear to provide evidence that cyberlearning can be as effective as traditional classroom learning Results from t-tests indicated that there were no significant differences on six of the eight academic variables in terms of student learning, for the most part the two groups achieved at approximately the same level as measured by test scores The findings of this study appear to provide preliminary evidence that cyberlearning can be as effective as learning in the traditional classroom. In general, there were no significant differences in academic outcomes when Cyberlearners were compared with Traditional Learners 90% of the Cyberlearners believed they learned as much or more than they would have in a traditional classroom |
| 1999 | Schulman, A H. & Sims, R. L. | T H E Journal T H E Journal - Vol 26, No 11 June Nova Southeastern University pp 54-56 | Our study demonstrates that the learning of online students is equal to the learning of in class students for our sample Interestingly, the group of students who self-selected into the online courses scored higher on the pretests than did the in class students This result is an indication that the students who select online courses may be better prepared for the course material than the students who select in class courses This preparedness may not, however, lead to greater learning since there were no significant differences between the two groups on students on their posttest scores |
| 1999 | Smeaton, A & Keogh, G | An Analysis of the Use of Virtual Delivery of Undergraduate Lectures Computers and Education - Vol 32 pp 83-94 | The results in this paper have shown that when virtual lectures are used in place of traditional delivery methods there is no significant difference in attainment level as measured by end of year examination marks |
| 1999 | Trinkle, D A | Distance Education: a Means to an End, No More, No Less The Chronicle of Higher Education - August 6, A60 | Increased competition among educational institutions offering such courses will probably reduce the costs non-traditional students will face For such students, there is clear evidence that distance education can be as successful as classroom-based instruction, if not more so |
| 1999 | Wade, W | Assessment in Distance Learning: What Do Students Know and How Do We Know that They Know It? H E. Journal, October - Vol 27, No 3 94-100 | grade distribution has shown repeatedly that students do as well in a distance learning atmosphere as they do in a physical classroom atmosphere it is true that students do as well in distance learning as in physical classrooms |

## Significant difference Studies

| Year | Author | Title & Type of work | Quote |
|---|---|---|---|
| 1991 | Chen, H., Lehman, J. & Armstrong, P | Comparison of Performance and Attitude in Traditional and Computer Conferencing Classes<br>The American Journal of Distance Education - Vol. 5, No. 3<br>pp. 51-64 | The outcomes measured included scores on achievement tests, time-on-task, student attitudes, and drop-out rates. While the results were mixed, the scores on achievement tests were highest for students taking a correspondence course and lowest for students participating in computer-mediated learning ... there was a **significant difference** in the attitudes of students, the computer-mediated learning group was less positive toward the course than the conventional classroom group |
| 1992 | Fulmer, J., Hazzard, M., Jones, S., & Keene, K. | Distance Learning: An Innovative Approach to Nursing Education<br>Journal of Professional Nursing - September-October; 8 (5)<br>pp. 289-294 | Review of course grades demonstrated that off-campus students achieved **higher grades** than on-campus students |
| 1993 | Martin, E. D. & Rainey, L. | Student Achievement and Attitude in a Satellite-Delivered High School Science Course<br>The American Journal of Distance Education - Vol. 7, No. 1<br>pp. 54-61 | At the high school level, a study compared the attitudes and achievements scores of students participating in an anatomy and physiology course taught in a regular classroom and delivered through interactive satellite ... the group taught via satellite had **higher** mean scores on an achievement test than students in the classroom |
| 1993 | Souder, W. E. | The Effectiveness of Traditional versus Satellite Delivery in Three Management of Technology Master's Degree Programs<br>The American Journal of Distance Education<br>pp. 37 - 89 | ... compared the results of a take-home essay exam for students who participated in a live broadcast televised graduate course in management of technology with the results for students in the on-campus classroom. The students participating in distance learning **performed better** than students in the conventional classroom ... With respect to homework, the distance students **performed at a higher level** " |
| 1997 | Despain, S. | The Effects of two Delivery Systems for the Listening Comprehension Exercises on the Language Performance and Attitude of Beginning Spanish Students<br>North Carolina State University<br>pp<br>http://sasw.chass.ncsu.edu/fl/faculty/despain/abst | Results of the study suggested that 1) students tend to **learn more effectively/efficiently** using the computer delivery system, 2) students who complete more exercises learn more (**significant** only for the computer group), 3) there is a **time advantage** to using the computer; 4) students who complete the exercises via computer have a **more positive attitude** toward the listening comprehension exercises, and yet a **less positive attitude** towards the delivery medium, when compared to their counterparts using the traditional format, 5) students in the computer group have a **more positive attitude** towards language learning in general " |
| 1997 | Gubernick, L. & Ebeling, A. | I Got My Degree Through E-mail<br>Forbes - 159 pp. 84-92 | ... a study conducted by the University of Phoenix ... demonstrated standardized achievement test scores of its online graduates were **5% to 10% higher** than graduates of competing on-campus programs at three Arizona public universities " |
| 1997 | Hammond, R. J. | A Comparison of the Learning Experience of Tele-course Students in Community and Day Sections.<br>A paper presented at the Distance Learning Symposium<br>Utah Valley State College, August | Both sections experienced a high percentage of students who **did not complete** the course ... The off-campus students had **much higher grades** than the on-campus students, although both groups rated the course as good or excellent. A higher proportion of on-campus students reported that they would **not recommend** the Tele-course to a friend |
| 1997 | Jewett, F. | SUNY Brockport and the SUNY Campuses in Western New York State: A Case Study in the Benefits and Costs of an Interactive Television Network<br>Seal Beach, CA: The Chancellor's Office California State University | Students at the receiving site attained **lower grades** than the students at the sending site. On the other hand, receiving site students in general portrayed a more positive attitude than sending site students |

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| 1997 | Rensselaer Polytechnic Institute | A Case Study in the Benefits and Costs of a joint Industry/University Designed Program Featuring Integrated Delivery Methods<br>Rensselaer Polytechnic Institute<br>pp.<br>http://www calstate edu/special_projects/medi ated | . it was surprising to note that those who watched by videotape rated the course **considerably higher** (4 57) than those who participated live and interactively by video conference (3 77). To the statement 'The technologies used made me uncomfortable.' the group that disagreed the most (indicating the **highest comfort level** ) were those using videotape, followed closely by the campus group. |
| 1997 | Vasarhelyi, M. & Graham, L. | Cybersmart Education and the Internet<br>Management Accounting - August<br>pp 32-36 | computer-based instruction yielded **higher** average scores that traditional instruction." |
| 1998 | Morrissey, C A | on Management Education: What the Research Shows Pepperdine University pp<br>http://horizon unc edu/TS/cases/1998-06 asp | Results showed that case study groups with groupware **significantly outperformed** traditional face-to-face groups . Group attitudes, including cohesion and satisfaction with the process and outcomes, were also consistent, in that electronic meeting groups tend to **score lower** than traditional groups |
| 1998 | Schutte, J G | Virtual Teaching in Higher Education<br>California State University, Northridge<br>pp<br>http://www csun edu/sociology/virexp htm | Results indicate the virtual students scored an average of 20 points **higher** on the 100 point midterm and final exams. All differences are **highly significant.** |
| 1999 | Dutton, J., Dutton, M., & Perry, J | Do Online Students Perform As Well AS Traditional Students?<br>Submitted for publication<br>North Carolina State University | A summary of our findings, then, is that, as a group, online students who completed the course did **significantly better** that lecture students. This result holds up when we consider undergraduate students only. For lifelong students the result is reversed, but the difference is not statistically significant |
| 1999 | Navarro, P. & Shoemaker, J | Economics in Cyberspace: A Comparison Study<br>Discussion Paper<br>University of California - Irvine, Graduate School of Management<br>pp 33 | we see that Cyber learners performed **significantly better** than the Traditional Learners Mean score [final exam] for the Cyber learners was 11 3 while the mean score for the Traditional Learners was 9 8. With a t-test statistic of 3 70, this result was **statistically significant** at the 99% level. |

Appendix (D)

Table (A)

Pre- and Post test results of ILA group Showing knowledge gain

t-Tests
Achievement by Group Membership
(Rita Richey 1989)

| Group | N | Mean | % Correct | SD | T | P |
|---|---|---|---|---|---|---|
| ILA Group (pre-test) | 389 | 15.38 | 66.9 | 3.16 | | |
| ILA Group (post-test) | 284 | 18.01 | 78.3 | 1.93 | 13.36 | .000+* |

* P = < .01

Table (B)

Pre- and Post test results of IVD group Showing knowledge gain

t-Tests
Achievement by Group Membership
(Rita Richey 1992)

| Group | N | Mean | % Correct | SD | T | P |
|---|---|---|---|---|---|---|
| IVD Group All (pre-test) | 147 | 15.19 | 69.05 | 2.667 | | |
| IVD Group All (post-test) | 90 | 17.26 | 78.45 | 1.827 | -6.47 | .000+* |

* P = < .01

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Abstract

A COMPARISON OF THE OUTCOMES OF INSTRUCTOR LED AND INTERACTIVE VIDEO DISK BASED ENERGY CONTROL AND POWER LOCKOUT AUTOMOTIVE TRAINING PROGRAMS

by

HAMMID M. W SIDDIQUI

December 2002

Advisors: Dr. Rita C. Richey and Dr. Donald R. Marcotte

Major: Instructional Technology

Degree: Doctor of Philosophy

Controversy has increased regarding merits of research comparing outcomes of different instructional media. This study used existing databases of two studies to compare post- intervention achievement of workers who participated in the Instructor Led Energy Control and Power Lockout (ECPL) training program and workers who participated in the Interactive Video-Disk (IVD) based ECPL training program in a nontraditional setting. The first group was provided the same training program, but used the traditional pedagogical approach that was instructor led.

A total of 378 employees at a major auto company participated in the study. Of this number 286 (75.7%) participants were in the traditional instructor-led group and 92 (24.3%) were in the IVD group. Post-test scores were compared from both studies to determine if significant differences existed due to differences in delivery system.

No significant differences were found in the training outcomes of knowledge, attitude toward safety, trainee perceptions of organizational behavior, trainee perceptions of general management attitude toward safety, on-the-job lockout performance and

failure to follow lockout procedures; between the groups that had different types of delivery for instruction during the training.

Based on the lack of significant differences between participants in the IVD and ILA groups on knowledge, it appeared that the content of the training was more important than the instructional delivery method. Attitudes toward training appeared to be similar, although significant differences were found between hourly and salaried personnel.

# AUTOBIOGRAPHICAL STATEMENT

## HAMID M. W. SIDDIQUI

## EDUCATION

| | | | |
|---|---|---|---|
| Dec, 2002 | Wayne State University | Ph.D | Major - Instructional Technology and Educational Evaluation & Research<br>Minor –Computer Science |
| Dec, 1987 | Wayne State University | M.Ed | Major - Instructional Technology.<br>Minor - Educational Evaluation & Research |
| April, 1974 | Detroit Institute of Technology | B.S | Major - Mathematics<br>Minor - Physics |

## ACHIEVEMENTS

- Developed the Word Tracking system for IBM mainframe to analyze a series of school text books. The project saved hundreds of work-hours, and increased accuracy in work to 99.9%. The project was exhibited at the annual conference of the International Reading Association held at Chicago in 1983.
- Converted Bunkaramo Corporation's On-line IBM-370 FORTRAN package that linked mainframe with teller terminals to operate on UNISYS, using overlay technique.

## APPOINTMENTS

**Wayne State University, Detroit,** Michigan.

(1) Course Evaluation office: Supervisor (1994 to Present)
(2) C & I T (Research Support laboratory) – Research Consultant (1990 to 1994)
(3) College of Education - Member of W.S.U evaluation team (1988 - 1992).
(4) Part-time Faculty - Inter Disciplinary Studies Program (1998 to present)

## RESEARCH AND PUBLICATIONS

| | |
|---|---|
| September 1988 | The Wayne State University Teacher Education Programs: A Study of Their Effectiveness; Rita C. Richey; Hamid Siddiqui; James Blake; Linda Lavine. |
| July, 1989 | An Evaluation of the UAW-Ford Energy Control and Power Lockout |
| February 1991 | Evaluation - Powered Material Handling Vehicles; A UAW-Ford National Joint Committee on Health and Safety Training Program; Principal Investigator - Dr. Rita C. Richey, College of Education, WSU. |
| August 1996 | Student Perceptions of Differences in Instruction Delivered by Part-time and full-time teaching Faculty as Indicated by SET Ratings. Hamid Siddiqui, Thomas Wilhelm. |
| June 1997 | Uses and Gratification of Imported Television Programs By Young Viewers In The Kingdom of Saudi Arabia; Adel Merdad, Larry Miller, and Hamid Siddiqui. |