LEARNING STYLES, LEARNER CHARACTERISTICS,

AND PREFERRED INSTRUCTIONAL ACTIVITIES IN

COMPUTER-BASED TECHNICAL

TRAINING FOR ADULTS

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Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
In partial fulfillment of
The requirements for
The Degree of
DOCTOR OF EDUCATION
December 2004

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CHARACTERISTICS, AND PREFERRED

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ACKNOWLEDGEMENTS

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CHAPTER I

INTRODUCTION

Introduction

Technology had changed the way we work, communicate, and learn. The

workforce was changing from single skilled industrial society workers to multi-skilled

postindustrial society workers with a need for lifelong learning. Technical professionals

could not expect to earn a living with one or two basic technical skills for their whole life.

In order to survive and stay competitive in this changing society, workers needed to keep

learning new skills and become lifelong learners (Kincheloe, 1995; Merriam and

Caffarella, 1991).

Typically, modern organizations spent most of their technical education

expenditures on providing technical professionals job-specific, intensive, and updated

technical training opportunities (Bassi et al., 1999). Many organizations were moving the

delivery of training from traditional instructor-led classroom training toward technology-

based training because its cost-effectiveness and flexibility (Ravet & Layte, 1998). The

2002 ASTD State of Industry Report stated that E-Learning reached record level while

classroom-based training declined from 79.7 percent in 2000 to 77.1 percent in 2001

(Thompson et al., 2002). Among Technology-Based Training delivery methods,

Computer-Based Training (CBT) was one of the most widely used techniques**,** and it

would probably continue to play an important role in training in the 21st century (Bassi et

al., 1999). Market research firm International Data Corporation (IDC) of Framingham, Mass., projected that the worldwide eLearning market would reach $10.6 billion in 2007 (Brennan, 2003).

Since the 1970's, researchers had studied the relationship between learners' learning preferences and different instructional strategies in the traditional classroom settings (Dunn & Dunn, 1978, 1992, Gardner, 1983, Kolb, 1985, Myers, 1987,). Studies used the Dunn and Dunn's (1978, 1992) learning style model, which delineated individual learners' reactions to 21 elements of instructional environments as learning preferences. Gardner's (1983) Multiple Intelligence theory proposed the existence of the following seven basic intelligences, Linguistic, Logical-Mathematical, Musical, Spatial, Bodily-Kinesthetic, Interpersonal, and Intrapersonal intelligences and suggested learning strategies that were most effective for each of them. Kolb's (1985) Learning-Style Inventory described each individual's learning style as a combination of the four basic learning modes which were Concrete--Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). Myers and Briggs' Type Indicator (1987) defined 16 personality types and their implications for learning.

There were also some studies of learners' learning preferences and Computer-Assisted Instructional methods. Martini's (1986) study showed there was a positive relationship between matching different Computer-Assisted Instructional methods with each learner's learning preference and his or her achievement in the subject. Buch and Bartley's study investigated the relationship between learning style and preference for different modes of training such as Computer-Based training, Classroom-Based training, TV-Based training, etc. They found that Convergers had a stronger preference for

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Computer-Based training while Assimilators were more appeal to Classroom-Based training (2002). However, there was lack of research of the relationship between adult learners' learning preferences and different Computer-Based instructional activities in the technical training settings.

Statement of the Problem

Studies had shown relationships between learners' learning styles and different instructional activities in traditional classroom settings. But research focusing on the relationship between adult learners' learning styles and different instructional activities in the Computer-Based technical training settings was virtually nonexistent. The problem was that there were no research-based guidelines to assist CBT instructional designers on how to best design CBT instruction.

Purpose of the Study

The purpose of this study was to describe the relationship and interaction between adult learners' learning styles, learner characteristics, and their preferred instructional activities within Computer-Based Technical training.

Research Questions

The following research questions guided this study:

1. What were the instructional activities in the Computer-Based Training of the participant program?;

2. What were the learning styles of adult learners engaged in using Computer-Based Technical Training?;

3. Which CBT instructional activities did participating adult learners like or dislike in their Computer-Based Technical Training?;

4. What was the relationship between adult learners' demographic characteristics and their like or dislike toward different instructional activities in their Computer-Based technical training setting?; and

5. What was the relationship between adult learners' learning styles and their like or dislike toward different instructional activities in their Computer-Based technical training setting?

Outcomes of the Study

A set of recommendations for instructional activities in Computer-Based Technical Training based on adult learning styles and learner characteristics were created as an outcome of this study.

Significance of the Study

The results of this study revealed if preferences existed between learning styles, learner characteristics and particular CBT instructional activities. These preferences then could help CBT instructional designers developed more effective future training programs for workers in adult technical education settings.

Assumptions

This study assumed that participants could honestly determine and report their degree of like or dislike for the instructional activities for the Computer-Based Training.

Limitations

This study was limited to the Computer-Based technical training programs at Richland College in Dallas, TX.

Organization of the Study

The second chapter of this study reports a review of the literature associated with this study. The third chapter, on methodology, includes an introduction and information about subjects, instruments, research design, and procedure, analysis of the data, and the statistical techniques. The fourth chapter reports the findings. Chapter five offers conclusions and recommendations for further study and practice.

Definition of Terms

The following definitions were either operationally defined or based on published definitions for this study:

Computer-Based Training (CBT): Training delivered, tested, or managed by computers. Munger (1996) defined the term Computer-Based Training (CBT) as the following:

> *CBT is an interactive training experience between a trainee and a computer, in which the computer provides much of the stimulus. The trainees are presented with information, quizzed, and tested. The program acknowledges whether they learned the material (p.55).*

Computer-Based Technical Training: Technical training delivered, tested, or managed by computers.

Highly Preferred Strategy: Any strategy that received a mean score of 4.0 or above.

Interactive Strategy: Strategies that allowed learners to physically interrelate with computers or others.

Learning Style: Rita Dunn defined learning style as the following:

> *A person's learning style is the way that he or she concentrates on, processes, internalizes, and remembers new and difficult academic information or skills. Styles often vary with age, achievement level, culture, global versus analytic processing preference, and gender (Shaughnessy, 1998).*

Less Preferred Strategy: Any strategy that received a mean score between 3.12 to 3.99.

Multimedia: ComputerUser Hi-Tech Dictionary (2004) defined the term multimedia as the following:

> *Multimedia is communication that uses any combination of different media, and may or may not involve computers. Multimedia may include text, spoken audio, music, images, animation and video. The large amounts of data required for computer multimedia file makes CD-ROMs a good option for storage; but there are other ways of receiving multimedia communications, such as the World Wide Web. Multimedia programs are often interactive, and include games, sales presentations, encyclopedias, and more.*

Non-Interactive Strategy: Strategies that did not allow learners to physically interrelate with computers or others.

Notable Difference: Any difference between the mean scores of 0.1 or greater.

Technical Education: Education to enhance learners' technical skills.

Technology-Based Training (TBT): Training delivered, tested, or managed by information technologies.

Virtual Reality: Reynolds defined Virtual Reality (VR) and discussed different types of Virtual Reality in the <u>ASTD Technical and Skills Training Handbook</u> (1994) as the following:

> *Virtual reality (VR) is a computer-generated simulated environment.*
> *The environment modeled in the VR system is called the virtual world. It*
> *is particularly useful to simulate conditions that do not actually exist, by*
> *VR may also be used to simulate actual potential conditions.*
> *There are two types of VR: Immersive and desktop. Immersive VR uses*
> *special peripherals, particularly data gloves and computer graphic*
> *head-mounted display (HMD). It gives the user the feeling of being*
> *present in a scene and able to move around in it. Desktop virtual reality*
> *is limited to standard desktop computer displays* (p.315).

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

This chapter contains a discussion of the theoretical framework and previous research relevant to learning styles and Computer-Based Training (CBT). The first section introduces several important learning style theories and then discusses developing instructional activities based on learners' learning styles. The focus of the second section is on Computer-Based training, on how CBT could meet the needs of different learning styles and examines some effective instructional activities for CBT.

Learning Style Theories

In Shaughnessy's (1998) interview with Rita Dunn, Dunn defined a person's learning style as follows:

A person's learning style is the way that he or she concentrates on, processes, internalizes, and remembers new and difficult academic information or skills. Styles often vary with age, achievement level, culture, global versus analytic processing preference, and gender (p.141)*.

Dunn and Dunn Learning Styles Model

Rita and Kenneth Dunn became learning styles-basis instruction advocates and had been well known researchers of learning styles since the 1970's (Pues, 1994 &

Wilson, 1994). They first became involved in learning style research when they were trying to help slow learners narrow the gap between their reading ability and the schools' expectations in the late '70s (Dunn & Dunn, 1978). They found that some instructional methods were highly effective with some learners but were not so effective with others. They then conducted literature reviews on educational and industrial research concerned with how people learned. They then developed Dunn and Dunn's Learning Styles Model. According to Dunn and Dunn's Learning Styles Model (Dunn & Dunn, 1978; Dunn & Dunn, 1992), a person's learning style could be determined based on 21 elements organized into five stimuli groups which were environmental, emotional, sociological, physical, and psychological stimuli groups. Those stimuli groups affected learner's learning.

Learners were either inhibited or stimulated by the four elements within the environmental stimuli group: sound, light, temperature, and design when they were trying to learn. For instance, some learners preferred to learn while listening to the music at the same time while some learners could only learn in a very quiet environment. Instructors could adjust the environmental elements based on the learners' preferences and provided a learning environment in which the learners felt most comfortable.

The emotional stimuli group contained motivation, persistence, responsibility, and structure elements, which were developed from their experiences. Learners had different motivational levels and could be differently motivated. For example, instructors could exactly tell what they expected of highly motivated learners to learn and what were the available resources. To teach learners who were less motivated, instructors could give them short assignments.

Peers, self, pairs, teams, adults, and a variation of these elements formed the sociological stimuli group in this learning style model. Some learners could learn best when they were learning as a team while some preferred learn by themselves. Therefore, Dunn and Dunn recommended that learners should be given the right to select the ways to complete their assignments.

In the physical stimuli group, perception, intake, time, and mobility were the elements. For instance, learners learned through different senses such as auditory, visual, and tactual senses. The recommendation was that instructors could identify learners' perceptions, and develop instruction, which would help learners to learn based on their preferred senses.

Finally, analytic vs. global, right vs. left-brain, and reflective vs. impulsive elements composed the psychological stimuli group. For instance, global learners preferred to see the overall picture before they learned while analytic learners could learn step by step without seeing the overall picture.

Gardner's Multiple Intelligences Theory

Intelligence testing introduced to the United State in the 1970s claimed that individual's intelligence could be objectively measured and reduced to an "IQ" (Intelligence Quotient) score (Armstrong, 1994). Harvard psychologist, Howard Gardner, argued that American culture had defined intelligence too narrowly and proposed the Multiple Intelligence (MI) theory in the early 1980s (Armstrong, 1994, Gardner, 1983). Gardner reviewed evidence from studies of prodigies, gifted individuals, brain-damaged patients, idiot savants, normal children, normal adults, experts in different lines of work, and individuals from diverse cultures (Gardner, 1983).

Based on the converging evidence from different sources, he developed a preliminary list of candidate intelligences. In his book Frames of Mind, he expanded the purviews of cognitive and developmental psychology, and examined the educational implications of MI theory (Gardner, 1983). Gardner's Multiple Intelligences (MI) theory recommended that all people possessed at least seven distinct forms of intelligence (1983). These intelligences were Linguistic, Logical-Mathematical, Musical, Spatial, Bodily-Kinesthetic, Interpersonal, and Intrapersonal Intelligence. The way each individual used the seven intelligences determined his or her learning style (Gardner, 1983 & Pues, 1994). People who had strong "Linguistic Intelligence" had the ability to communicate effectively through writing and verbal communication and could learn best by verbalizing and seeing words. "Logical-Mathematical Intelligence" enabled people to use numbers effectively and to have good logical thinking skills. People with strong "Musical Intelligence" had the ability to perceive and use musical forms. "Spatial Intelligence" referred people's capability to perceive visual-spatial relationships. People with strong "Bodily-Kinesthetic Intelligence" processed knowledge through bodily sensations and had the ability to effectively use physical skills. "Interpersonal Intelligence" reflected people who were sensitive to social relationships. Finally, people with high "Intrapersonal Intelligence" were aware of their own capabilities, temperament, strengths, and weaknesses, and they preferred independent projects (Gardner, 1983).

Kolb's Experiential Learning Model

Kolb's experiential learning model drew from the intellectual origins of experiential learning in the works of John Dewey, Kurt Lewin, and Jean Piaget (Kolb, 1984). The learning process based on research in psychology, philosophy, and

physiology had bolstered Kolb's model. Kolb compared Dewey, Lewin and Piaget's learning models and then identified the common themes that characterized the experiential learning process (Kolb, 1984). He also reported converging evidence from the fields of philosophy, psychology and physiology describing two structural dimensions of the learning process. The apprehension dimension included two opposed modes of grasping experience: one via immediate concrete experience and the other via symbolic representations of experiences. The other structural dimension was a transformation dimension that included two opposed modes of transforming experience: one via intentional reflection and the other via extensional action (Kolb, 1984). Kolb said learning was a complex process, and this process was not the same for everyone. According to Kolb (1984), each individual had his or her own orientation toward gathering and processing information during the learning process which was called the mode of learning. The four basic modes of the learning in Kolb's experiential learning model (Kolb, 1985) were the Concrete --Experience (CE), the Reflective Observation (RO), the Abstract Conceptualization (AC) and the Active Experimentation (AE).

1. Concrete-Experience (CE) mode focused on a preference for learning through direct experience and dealing with immediate human situations in a personal way. This mode emphasized feeling as opposed to thinking. Learners with a CE learning mode enjoyed and were good at relating to others. They were also good at intuitive decision-making.

2. Reflective-Observation (RO) mode focused on a preference for learning through careful observation and impartial description. This mode emphasized understanding as opposed to doing. Learners with a RO learning mode

enjoyed using their own thoughts and feelings to form opinions and were good at seeing things from different perspectives.

3. Abstract-Conceptualization (AC) mode focused on a preference for learning through logic, ideas and concepts. This mode emphasized thinking as opposed to feeling. Learners with an AC learning mode enjoyed and were good at systematic planning, manipulation of abstract symbols and quantitative analysis.

4. Active-Experimentation (AE) mode focused on a preference for learning through practical application. This mode emphasized doing as opposed to reflective understanding. Learners with an AE learning mode enjoyed and were good at getting things done.

Kolb believed that each individual's learning style was usually a combination of two modes of learning. Based on his experiential learning theory, Kolb had identified the four basic learning styles of convergent, divergent, assimilation, and accommodative learning styles. Learners of these four different learning styles were called Converger, Diverger, Assimilator, and Accommodator.

1. A Converger was the combination of Abstract Conceptualization (AC)-thinking and Active Experimentation (AE)-doing. This type of learner preferred to deal with things rather than people and was best at finding practical uses for ideas and theories. Converger could do best where there was a single correct answer to a question.

2. A Diverger was the combination of Concrete Experience (CE)-feeling and Reflective Observation (RO)-watching. Different than Converger, Divergers

were interested in people and were good at generating ideas and seeing things from different perspectives.

3. An Assimilator was the combination of Abstract Conceptualization (AC)-thinking and Reflective Observation (RO)-watching. This type of learner was more concerned with abstract concepts than with people and was good at putting a wide range of information into logical form. They were good at inductive reading and creating theoretical models.

4. An Accommodator was the combination of Concrete Experience (CE)-feeling and Active Experimentation (AE)-doing. This type of learner preferred learning by doing. They were good at carry out plans and getting involved in new experiences.

Myers-Briggs Type Indicator

In the 1920's psychologist Carl Jung invented psychological types and wrote that people were different in fundamental ways (Keirsey & Bates, 1984). Jung proposed that psychological type was formed by the combination of four preferences concerning the use of perception and judgment. The four opposing preferences were Extraversion-Introversion, Sensing-Intuitive, Thinking-Feeling, and Judging-Perceptive (Heineman, 1995). In the 1950's Isabel Myers revisited Jung's psychological type and devised the Myer-Briggs Type Indicator with her mother Katheryn Briggs. The Myers-Briggs Type Indicator based on Carl Jung's theory of personality type assumed that an individual's personality could be divided into four scales: energizing, attending, deciding, and living (Campbell, 1999). The energizing scale: Extraversion (E) vs. Introversion (I), measured an individual's preferred orientation of life. "Extroverts" were oriented to the outer world

of people, objectives, and activities, while "Introverts" focused on the inner world of ideas, emotions, and concepts. The preferred way to view the environment was measured by the attending scale-Sensing (S) vs. Intuition (N). The letter I signified introversion and letter N represented Intuition. "Sensing" people were facts-oriented and preferred to gather data directly from their sense organs. "Intuitive" people preferred to include insights from the unconscious mind and paid attention to what might have been or what would be in the future. The deciding scale-Thinking (T) vs. Feeling (F), measured how individuals made decisions. Before "Thinking" people made decisions, they preferred to structure and organize information in a logical and objective way. "Feeling" people organized information in a personal and value-oriented way. Finally, the preferred way to respond to situations was measured by the living scale, Judgement (J) vs. Perception (P). "Judgement" people preferred to live a systematic and organized life, while "Perception" people chose to live a flexible and spontaneous life.

Individuals preferred one of the two opposites on each scale, which made up the following 16 different personality types (Booth & Winzar, 1993; Campbell, 1999; Keirsey & Bates, 1984; Briggs-Myers & McCaulley, 1985; Wilson, 1994): ENFJ, INFJ, ENFP, INFP, ENTJ, INTJ, ENTP, INTP, ESTJ, ISTJ, ESFJ, ISFJ, ESTP, ESFP, ISTP, and ISFP.

According to Keirsey and Bates (1984), there were four different learning styles based on those 16 different personality types: SP learning style; SJ learning style; NT learning style; and NF learning style.

1. SP type of learners [ESTP, ESFP, ISTP, and ISFP] enjoyed performing, needed hands-on learning activity, thrived on competition, and would learned from media presentations.

2. SJ type of learners [ESTJ, ISTJ, ESFJ, and ISFJ] preferred question-and-answer sessions led by the teacher, and they learned well under the Socratic method of instruction.

3. NT type of learners [ENTJ, INTJ, ENTP, and INTP] tended to be independent learners. The NT learners responded well to verbal, logical, well-reasoned dialogue. They felt comfortable with a logical presentation of material to be learned and could follow up through independently reading.

4. NF type of learners [ENFJ, INFJ, ENFP, and INFP] enjoyed interaction. They preferred instructional methods such as discussion, role-playing, dramatic play, and through fiction (Keirsey & Bates, 1984).

Developing Instructional Activities Based on Learners' Learning Styles

Studies showed that students' achievement and motivation improved when teachers' instruction matched students' learning styles (Wakefield, 1993, Dunn et al., 1995 and Gee, 1996). According to Dunn, Griggs, Olson, Forman, and Beasley's (1995) meta-analysis of 42 experimental studies by thirteen different higher education institutions conducted with the Dunn and Dunn learning style model between 1980 and 1990, students who received instruction appropriate to their learning styles could be expected to achieve .75 of a standard deviation higher than students whose teachers' instruction were not appropriate to their learning styles. These studies also indicated that

there was a positive relationship between students' academic achievements in traditional

classroom settings and instruction that correlate with students' learning styles.

Computer-Based Training

Munger (1996) defined the term Computer-Based Training (CBT) as the

following:

> *CBT is an interactive training experience between a trainee and a*
>
> *computer, in which the computer provides much of the stimulus. The*
>
> *trainees are presented with information, quizzed, and tested. The*
>
> *program acknowledges whether they learned the material* (p.55).

According to Tucker (1997) the idea of using computers as learning tools had

attracted both the training industry and the computer industry when computers were first

invented. Earlier computer-based training programs were delivered via mainframe

computers. Computer programmers were the first to exploit the computer as learning tool

since they were the only ones who had programming skills to work with the early

computers. Most of those computer programmers were lacking in expertise in training

and curriculum design. Therefore, the computer-based training programs they produced

did not lead to effective learning experiences. Laine's research showed the high drop-out

rate was the problem with the Computer-Based Information Technology training she

studied (June, 2003). The rapid changes of technology had enabled trainers to include

analogue movies and computer images which created stimulating and effective training to

their computer-based training in the 1960s and 1970s (Tucker, 1997). When digitalized

interactive video first became available, video companies assumed the role as training

producers with little or no knowledge of the training and learning process and produced

poor quality CBT. Fortunately, there were training and learning specialists who worked

with technical specialists and produced higher quality CBT courseware (Tucker, 1997).

Private organizations, schools, and government agencies could either use off-the-shelf

CBT packages or purchase different CBT courseware then input their training content by

their own staff or by the consultants they hired (Palloff & Pratt, 1999, Ravet & Layte,

1997). The increasing power of multimedia, the Personal Computer (PC), and

telecommunications technology allowed today's trainers to deliver multimedia CBT via

CD-Rom, Internet, and desk-to-desk conferencing (Tucker, 1997). Technology such as

virtual reality was still in its infancy and was not yet widely used by the private

organizations and schools in their CBT programs yet (Ravet & Layte, 1997).

Studies showed that one important trend of corporate technical training as the

movement toward increased use of Computer-Based Training (Rath & Gaudet, 1998;

Wilson, 1999; Bassi et al, 1998). The following were several computer technologies that

were most frequently used in today's workplace. The "2002 ASTD State of the Industry

Report" pointed out that in 2002 81.3 percent of the leading edge organizations were

using multimedia, 61.5 percent were using Computer-Based Training (CBT), 47.9

percent were using teleconferencing, and 36.5 percent were using groupware as their

presentation methods (Thompson et al., 2002). The same report also projected that by the

year 2004 85.9 percent of the organizations would use multimedia, 69.6 percent CBT,

60.9 percent teleconferencing, and 54.3 percent groupware to present their technical

training (Thompson et al., 2002).

As cited above, Multimedia as projected to be used by 85.9 percent leading edge organizations in the year 2004 (Thompson et al., 2002). Multimedia could be delivered via various technologies such as the World Wide Web (WWW), CD-ROM, etc. ComputerUser Hi-Tech Dictionary (2004) defined the term multimedia as the following:

Multimedia is communication that uses any combination of different media, and may or may not involve computers. Multimedia may include text, spoken audio, music, images, animation and video. The large amounts of data required for computer multimedia file makes CD-ROMs a good option for storage; but there are other ways of receiving multimedia communications, such as the World Wide Web. Multimedia programs are often interactive, and include games, sales presentations, encyclopedias, and more

(http://www.computeruser.com/resources/dictionary/dictionary.html).

Organizations chose to use interactive multimedia to be their training tools, because it could save time, expenses, and traveling. Multimedia could also facilitate self-paced training. Hall said the reasons that made interactive multimedia an effective instructional delivery method were that learners could received responses of their actions immediately, and interactive multimedia graphics, animation, audio and video provided a more realistic environment and made the training more effective (1997). The former lead designer of the Web Interactive Training (WIT) project at the NASA Kennedy Space Center, David MetCalf (as cited in Hall) said that it was more effective and efficient to

use interactive multimedia to deliver the training to the NASA employees (1997). The

main purpose of the Web Interactive Training (WIT) project was to train a large amount

of NASA employees to be able to use interactive multimedia technology to enhance their

learning. Two courses taught in the WIT project were prepared for managers who were in

quality control, safety and reliability areas. The Nondestructive Evaluation Overview

course developed learners' ability to test material integrity of a component without

damage. The Introduction to Statistical Processes taught the learners a monitor processes

method. The instructional system designers worked with subject matter experts and

determined the objectives, content and methodologies of each guided discovery learning

module by following an expansion of the Topic, Task, and Test model. The WIT was

both a Computer-Based Instruction (CBI) and Computer-Managed Instruction (CMI)

project. This project used interactive multimedia modules as their Computer-Based

Instructional method to deliver the training via Internet 24 hours a day, seven days a

week. This way, learners had opportunities to decide when and where to receive their

training. After the learners met the acceptable proficiency level of the module, they

could choose to learn more about the subject or stop right where they were. A randomly

generated short multiple-choice quiz was given to the learners. They received their

scores, explanation of the answers and a link to the specific topic immediately after they

submitted their quiz via the web. The Computer-Managed Instruction (CMI) enabled

instructional designers to track the completion of the training session, learners' current

training activities, and the learners' scores. This information provided good indications

on the effectiveness of the training to the instructional designers. MetCalf (as cited in

Hall) said that it was more effective and efficient to use interactive multimedia to deliver

the training to the NASA employees, because this training delivery method was less expensive than traditional training delivery method and was more convenient for the trainees (1997).

<p style="text-align:center;">*Multimedia via CD-ROMs*</p>

There were several distribution methods that could be utilized for delivering interactive multimedia training. Sixty-seven point seven percent of the leading edge organizations used CD-ROMs in 2001, and this number was predicted to be 75.8% in the year 2002 (Thompson et al., 2002). Trainees only needed to have a computer with Computer Disc (CD) drive and a CD-ROM (Computer Disc Read-Only Memory) to receive interactive multimedia training via CD-ROMs. Lectures, seminar, games, simulations, the library, etc. were some appropriate instructional methods that could be used to train adults via multimedia CD-ROM (Harasim, 1989, Paulsen, 1995).

Motorola, a telecommunication company with more than 152,000 employees world-wide, used CD-ROM as one of their distribution methods to deliver their just-in-time training in a cost effective manner (Hall, 1997). Motorola cooperated with Carnegie Mellon University and developed the Just-In-Time Lecture series. The Just-In-Time-Lecture series packaged subject experts' presentations, slides, and frequently ask questions (FAQs) with answers onto a CD disk, and was sent overnight to those who were interested. One advantage of multimedia delivery via CD-ROMs as that organizations could provide standardized, timeless, and cost-effective interactive multimedia training via CD-ROMs. It would cost big companies such as Motorola much more time and money to bring in 100 trainees from all over the world to receive a half-day training. According to the CEO of Design Access, Carol English, to purchase a very

sophisticated machine, which supported multimedia would cost only from $12,000.00 to $15,000.00 and the cost of setting up a multimedia orientation system as from $30,000.00 to $500,000.00 (1998). However, delivering multimedia via CD-ROMs was still not as timeless as multimedia delivery via Internet or intranet. One reason for this was that every time organizations wanted to make some changes of the training, they needed to change the CD-ROM and ship them to people who needed the training.

Multimedia via Internet

Savitz said that the computer-based training industry had gradually begun shifting from delivering training via CD-ROMs to via Internet (1998). Thompson, Koon, Weedwell, and Beauvais (2002) stated 75.8 percent of the leading-edge organizations were projected to be using CD-ROMs; 76.9 percent were predicted to be using Intranet, and 48.4 percent of them were expected to be using Internet by the year 2004 in their 2002 ASTD State of the Industry Report (2002). Lifelong Learning Market Report by Simba projected that live e-learning such as virtual classrooms and Web-Based training was expected to grow 20% in 2003 to $172.7 million (2003).

Some advantages of delivering multimedia or Computer-Based Training (CBT) via either Internet or Intranet were as the following:

- Delivery of Multimedia/CBT via Internet/Intranet centralized training. If a training department wanted to update their training schedule, they could make changes on the server and every trainee who had access to the Internet/Intranet would find the most updated schedule from their desktops right away;

- Delivery of Multimedia/CBT via Internet/Intranet standardized the training. If an organization wanted to offer a business law course to over 1000 employees, they

could insure the quality of the trainer and the training program would be the same

through the CBT via Internet/Intranet; and

- Delivery of Multimedia/CBT via Internet/Intranet was convenient for trainees.

  Trainees had more control on when and where to receive their training and the pace

  of their learning. If a trainee decided he could learn best at midnight, he could log on

  to the Internet/Intranet from his home computer at midnight and received the training.

  He did not even need to bring home a CD-ROM to receive the training.

  Multimedia/CBT via Internet/Intranet especially worked best for people who worked

  the night shift. Most of the traditional training sessions met during the day, which

  usually was bedtime for night shift workers. The training would be more effective if

  the night shift workers could receive their training during evening hours (Rath &

  Gaudet, 1998, Wilson, 1999).

Although there were many advantages of delivering multimedia/CBT via

Internet/Intranet, there were some challenges. Daiz (1998) described some technological

barriers to delivering multimedia/CBT via World Wide Web (WWW) including the

following:

- Network connections were not always reliable. There were times that the server was

  down, and trainees could not receive the training when they wanted; and

- Technological problems such as insufficient bandwidth and data transmission

  congestion could make the WWW become the "World Wide Wait" which could

  cause trainees lots of waiting time.

Some solutions to the technological problems were CD/Web hybrids, streaming

video and audio, and HD (hard drive)/ Web hybrids. Based on the interview with Bryan

Chapman, director of product management at Allen Communication, Kenyon (1997)

listed the following five most common delivery methods that organizations were using

for their Internet/Intranet based training: HTML (Hypertext Markup Language); Java;

Download and Play; Plug-in; and Client Player.

- HTML was the code language that was used to create WebPages on the Internet.

  Internet users used Internet browsers such as Netscape and Internet explorer to view

  the WebPages on the Internet. The two advantages of using HTML were that this

  application was standard, and it was easy to use. There were many HTML authoring

  tools such as FrontPage, PageMill, and Dreamweaver available on the market which

  would allow users to develop or edit homepages without knowing the HTML code.

  The disadvantage of HTML was its limited functions would not allow users to

  develop a very interactive Internet based training;

- Java was a programming language that allowed users to create animations, games and

  click and drag application on the WebPages. The advantage of using Java was it

  could create an interactive training with its interactive features. The disadvantage of

  it was that the organizations would need to find computer programmers or engineers

  to write Java Scripts;

- Download and play was another way to deliver Internet-based training. The

  organization could send an imbedded training package through email first and let the

  trainee download the training package from an Internet server to his/her own hard

  drive. The advantages of using Download and Play were that it could keep courses

  confidential, and it could deliver interactive training. Only the trainee who the

  organization emailed training package to could download the training package from

an Internet server. The disadvantages of using Download and Play were that it took a

long time to download the whole training package, and the trainee needed to have a

hard drive big enough to store the training package. However, if the trainees

downloaded the training package from the Intranet, which was the network within the

organization, it would not be so time consuming. But building an Intranet could cost

millions based on the organization's size and needs;

- Plug-ins, such as Shockwave plug-in and Neuron plug-in, were programs that would

  tell browsers such as Netscape and Internet Explorer how to read those multimedia

  files made by authoring tools. Although Internet browsers could read HTML and

  Java, the browsers did not usually know how to read those files. The advantage of

  plug-ins was that trainees could receive interactive training programs with plug-ins

  installed their computers. The trainees would need to download the plug-in from a

  plug-in Website, install it to their computer, and configure the plug-in for the first

  time. The disadvantage was that hiring computer technicians to download, install,

  and configure every trainee's computer could potentially cost a lot of money.

  Another disadvantage was that it sometimes could take a long time to download the

  training program; and

- Client player technology or browserless training allowed trainees to receive their

  training on their desktops without using browsers, such as Netscape and Internet

  Explorer. Browserless training was more like CD-ROM-based training. Trainees

  needed to install the software before a course started. The advantage of browserless

  training was that it could provide a more controlled learning environment. Since

  trainees would not need to use browsers during their training process, they had less

opportunity to surf on the Internet and get distracted during the training process.
However, it also meant that trainees could not quit just anytime they wanted during
the training. They had to complete the whole training process before they could exit
the program. Since client player applications were still new to the market, there were
not many authoring tools available for creating the applications.

<div align="center">

Virtual Reality

</div>

Reynolds defined Virtual Reality (VR) and discussed different types of Virtual
Reality in the ASTD Technical and Skills Training Handbook (Kelly, 1994) as the
following:

> *Virtual reality (VR) is a computer-generated simulated environment.*
>
> *The environment modeled in the VR system is called the virtual world. It*
>
> *is particularly useful to simulate conditions that do not actually exist, by*
>
> *VR may also be used to simulate actual potential conditions.*
>
> *There are two types of VR: Immersive and desktop. Immersive VR uses*
>
> *special peripherals, particularly data gloves and computer graphic*
>
> *head-mounted display (HMD). It gives the user the feeling of being*
>
> *present in a scene and able to move around in it. Desktop virtual reality*
>
> *is limited to standard desktop computer displays* (p.315).

Interactive simulations, drill and practice, role-play were some instructional
strategies that instructional designers used via Virtual Reality (Ravet & Layte, 1997).
Several industries had already incorporated Virtual Reality into their training due to the
expenses that would be involved in creating the real environment and the dangers trainees

might encounter. But the high cost of VR had caused most industries to avoid using it in their training. Thanks to the rapid developments in the computer industry, VR was becoming more affordable.

Some advantages of using VR included the following: might reduce learners' cognitive loads, could provide a learner-centered training environment, allowed trainees to have hand-on experience, could cut trainees' time on traveling, and could deliver standardize high-quality training to the trainees without any location restriction.   Psotka (1995) said that trainees needed to convert two-dimensional training materials into three-dimensional representations during the learning process which increased the learners' cognitive loads. Since the virtual reality environment was a three-dimensional environment, learning under this virtual reality environment might reduce learners' cognitive loads. One of the disadvantages of using VR in the training was that there as not enough research done on how to effectively use VR in training. Therefore, it still took extensive time to develop an effective VR training. Besides, simulation sickness such as fatigue, headache, and eyestrain had been found in VR training (Steele-Johnson & Hyde, 1996).

<div align="center">Adult Learning</div>

Knowles' theory of adult learning described adults as goal-oriented, problem-centered, and self-directed learners in Merriam and Caffarella's <u>Learning in Adulthood</u> (1991).   Adults needed to know when, why, what, and how they were going to learn. They learned best when they could decide when, where, and how to learn Knowles (1980) identified the following characteristics of adult learners:

- The need to know. Adult learners needed to know the purpose of the learning. They wanted to know the needs of the learning;

- Experience. Adult learners had a variety of experience. Experience provided the basis for learning activities;

- Self-concept. Adult learners were generally self-directed. They needed to be responsible for their own decision;

- Readiness to learn. Adult learners were ready to learn when the learning outcomes would help them effectively coping with the real-life situations; and

- Orientation to learning. Adult learners were motivated to learn when they saw the immediate relevance to their professional or personal life.

Recommended Instructional Activities for CBT

Upon the review of the literature, there are different instructional activities that Instructional Designers used for Computer-Based Training.

Some effective instructional activities that could be used in CBT were case studies, cooperative learning activities, drill and practice, instructional games, learning contracts, lecture, online databases, online journals, online libraries. presentation, project-based instruction, role-play exercises, self-directed learning, simulations, and student and teacher led discussion (Anderson, 1999, Armstrong, 1994, Harasim, 1989, Martin et al., 1999, Paulsen, 1995, Ravet & Layte, 1997, Foshay, 1999, Brooks et al., 2000).

Since the 1970's, researchers had started conducting many studies on the learning styles, and the relationship between learners' learning preferences and different

instructional strategies in the traditional classroom settings. Studies showed that learners'

achievement and motivation improved when instructors' instruction matched learners'

learning styles. However, research focusing on the relationship between adult learners'

learning styles and different instructional activities in the Computer-Based technical

training settings iwas virtually nonexistent. Thus, this study attempted to add to the body

of knowledge in investigating the relationships between learning styles, learner

characteristics and different instructional activities in the Computer-Based technical

training settings.

CHAPTER III

METHODOLOGY

Introduction

This chapter includes the description and selection of subjects; the evaluation and selection of the appropriate instrumentation; theoretical framework; and the research design, procedures, and analysis performed on the data.

Population

Trainees who were enrolled in the regular Computer-Based Technical Training Cisco Networking Academy Program at Richland College in Dallas, Texas served as the population for this study. All trainees who were enrolled in the summer 2002 semester, 83 in number, were solicited to participate in this study. These students were all adult students who were working or aspiring to work in the computer repair industry.

Instrumentation

To identify participant trainees' learning styles, Kolb's Learning-Style Inventory (LSI) was used. To gain insight into trainees' likes and dislikes for different CBT instructional activities, the researcher developed and used a Learning Questionnaire. The participants were asked to first complete the Kolb's Learning Style Inventory (See Appendix A), and then responded to the Learning Questionnaire (See Appendix B). A

cover letter to participant trainees that explained the purpose and the steps to participate this study was attached to the instruments (See Appendix C).

<center><u>Instrument 1: Kolb's Learning-Style Inventory</u></center>

After the researcher reviewed different learning theories and learning-style inventories; and the researcher decided to use Kolb's Learning-Style Inventory for this study for the following reasons:

1. Kolb's Learning-Style Inventory was easy to read for the participants; and

2. Completion time of the instrument took the participants only ten minutes during their training. Since the participants were asked to complete both the Learning-style inventory and the Learning Questionnaire at once, each inventory did not take participants much time to complete.

The Learning-Style Inventory was first developed in 1976, and then revised in 1985, by David A. Kolb. The purpose of the Learning-Style Inventory was to help adults identify different learning styles and learning environments corresponding with those styles (Strawbridge, 1991). This instrument contained 12 simple sentences, and each sentence had four endings. Respondents were asked to rank the four sentence endings that corresponded to the four learning modes for each sentence.

The following was an example of a completed sentence set in Kolb's Learning Style Inventory (Kolb, 1985, p.2).

1. When I learn: _____ *I am happy.* _____ *I am fast.*

_____ *I am logical.* _____ *I am careful.*

(4= most like you, 3= second most like you, 2=third most like you, 1=least like you)

After the respondents completed all 12 sentence sets, the respondents were asked to add the ranking values for corresponding responses yielding four primary scores each representing a learning mode. The four learning modes in this inventory were Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). To get two composite scores, the respondent was asked to subtract the score of CE from the AC score (AC-CE) and subtracts RO from AE (AE-RO) and then place the composite scores on the following scale.
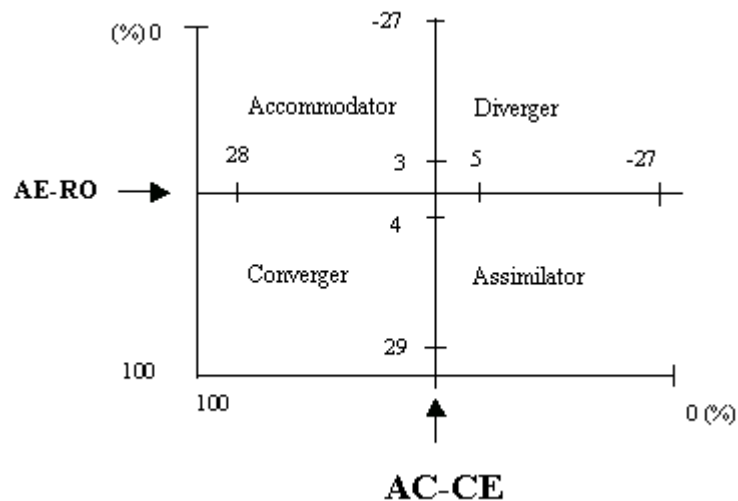
Based on the scores, individuals then identified one of the following four learning-styles that best described how they learned best: Accommodator, Diverger, Converger, or Assimilator.

Validity was the most important characteristic of an instrument. Validity was the degree to which an instrument measured what the researcher intended to measure (Gay and Airasian, 2000). Certo and Lamb (1980) criticized the LSI as it did not measure the underlying learning construct. In the technical specification manual, there was only one section that provided a graphic description of the validity relationship between learning styles and career field of study (Training Resources Group, 1995). However, Loo (1996)

suggested to use Kolb's LSI as a valid classificatory system. Cornwell, Manfredo and Dunlap (1991) also thought that Kolb's LSI held strong face validity. Kolb proposed to use the LSI as "analytic heuristic" for studying learning (1985). This researcher used the LSI to explore the styles of learning which fit the type of use Kolb proposed.

Reliability was the consistency of measurement (Nation, 1997). Reliability was expressed numerically. If an instrument's reliability coefficient was 1.00, the instrument was perfectly reliable.

The internal reliability the LSI 1985 (The Leaning Style Inventory revised in 1985) was very good on all six LSI scales (Training Resources Groups, 1995). Alpha coefficient measured by Cronbach's Estimate of Internal Consistency reported the score of .82 for Concrete Experience (CE), .73 for Reflective Observation (RO), .83 for Abstract Conceptualization (AC), .78 for Active Experimentation (AE), .88 for Abstract-Concrete (AC-CE), and .81 for Active-Reflective (AE-RO) (n=268). The combination scores indicated almost perfect additivity (1.0) as measured by Tukey's Additivity Power Test. The Spearman-Brown Split-Half coefficients ranged from .85 for Abstract-Concrete (AC-CE) to .71 for Reflective Observation (RO) which indicated a good split-half reliability of the instrument. The high correlation scores ranged from .93 for Active-Reflective (AE-RO) to .87 for Reflective Observation (RO). These scores showed strong correlations between the LSI 1985 and the original LSI instrument which indicated their results were comparable (n=268). Intercorrelations among the raw scores followed the predictions of experiential learning theory. There were strong negative relationships between AC and CE, and AE and RO (n=1,446). According to Gregg (1991), the four

basic scales and two combination scores of the Learning-Style Inventory (LSI) all showed good reliability as well.

<div align="center"><i><u>Learning Questionnaire</u></i></div>

Learners' characteristics and their like or dislike for different instructional activities in CBT were determined by the Learning Questionnaire developed by the researcher. The following were the steps that the researcher used to design the Learning Questionnaire:

1. The researcher reviewed literature and instruments related to learning styles, instructional strategies and activities, and learners' preferences toward different instructional strategies and activities;

2. The researcher reviewed the CBT curriculum of the Cisco Networking Academy program at Richland College and developed a list of instructional strategies and activities utilized and categorized them into Interactive and Non-Interactive;

3. Based on the literature, the instruments reviewed by the researcher and the Cisco curriculum, the researcher designed a questionnaire with a Likert-type scale to indicate the degree of like or dislike for each of the instructional strategies. Three open-ended questions were placed at the end of the instrument to provide deeper insights about the participants' responses;

4. After initial instrument design, the researcher pilot tested this instrument with Richland College Cisco training instructors to review the readability and content validity of this questionnaire. Cisco training instructors were appropriate to serve as the pilot test group due to their expertise in the fields of curriculum design,

computer-based training, adult education, technical training, and instructional

technology; and

5. The results of the pilot test ended up with no changes to the instrument.

Theoretical Framework

Cronbach and Snow's Aptitude-Treatment Interaction (ATI) served as the

theoretical framework for this study. According to Cronbach and Snow (1977), people

learned in different ways. No one way was better than the other. They were just

different. Some instructional strategies were more effective than the other strategies for

particular learners based on the learners' specific aptitudes. For optimal learning

outcomes, instructional strategies should match the learners' aptitudes. ATI was used to

predict educational outcomes from combinations of treatments and aptitudes. The

outcomes of this study were learners' preferences toward different instructional

strategies. Different instructional strategies were the treatments. Learning styles and

learner characteristics were the aptitudes of this study.

Research Design and Procedure

This descriptive study employed a quantitative method with some qualitative

components. This study sought to investigate the relationship between adult learners'

learning styles, learner characteristics and learners' like or dislike for different

instructional activities used in the Computer-Based Technical training. Kolb's Learning-

Style inventory was used to identify the participant's learning styles and the Learning

Questionnaire was used to identified the learners' characteristics, their like or dislike

toward the different categories of instructional strategies and activities in the CBT

curriculum. Open-ended questions in the Learning Questionnaire were the qualitative

components of this study. The qualitative component provided personal insight into their

reasons for why learners liked or disliked the instructional strategies.

Procedure

The researcher contacted 30 organizations in the southwest region by letters,

telephone calls, and/or emails and asked if they were using CBT in their technical

training. The researcher also checked the organizations' interests to become the partner

organization for this study. Dr. Joan Warren of Oklahoma State University introduced

the researcher to President Steve Mittelstet of Richland College. He then put the

researcher in contact with two Vice Presidents of Richland College. After the researcher

met with both Vice President Tony Summers in person and Vice President Kay Eggleston

of Richland College over the telephone, the researcher invited Richland College to

become the partner organization of this study by submitting the proposal for this study.

Vice President Eggleston informed the researcher that her proposal was approved

by the President's Cabinet of Richland College in March 2002, and she should contact

the Dean of Educational and Administrative Technology, Martha Hogan, on how to

access CBT trainees to participate this study.

The researcher met with Dean Hogan in April, 2002 and selected the Cisco

Networking Academy Program to be the participating program for the following reasons:

- Eighty-three trainees were enrolled in the Cisco Networking Academy
  Program. This was the only CBT program with more than 80 trainees at
  Richland; and

- Direct access to the population. The trainees met in a lab environment for this CBT. Direct access to the population might encourage response rate for this study.

The researcher met with one of the instructors for the Cisco Networking Academy Program and gained more background information about this program, identified the list of instructional strategies used in this CBT curriculum, and discussed the logistics of how to collect data at Richland College. The researcher developed the Learning Questionnaire after this meeting.

After the researcher developed the Learning Questionnaire, 5-10 Cisco instructors were asked to participate in the pilot test of the questionnaire. Pilot test occurred in May 2002. The results of the pilot test ended up with no changes to the instrument.

These same instructors of the Cisco Networking Academy Program were asked to assist in the data collection process. The researcher provided the instructors who participated in the study an orientation which included the purpose of this study and how to administer the instruments.

After two weeks that classes began, during a designated class meeting, the instructors distributed a packet that contained a cover letter, which explained this anonymous voluntary-based study, Kolb's learning style inventory and the Learning Questionnaire to all students in the Cisco courses. The students who volunteered then completed the instruments and returned them to the instructors.

The researcher collected the completed questionnaires from the instructors.

The researcher analyzed and coded the data from the returned Kolb's LSI instrument and identified and coded each participant's learning style.

The researcher then analyzed the data on the returned Learning Questionnaire and identified the participants' characteristics and likes or dislikes toward the different CBT instructional strategies and activities.

Finally, the researcher analyzed the data and described the relationships between learning styles, learner characteristics and the participant's like and dislike toward the different categories of CBT instructional strategies and activities. Any difference between the mean scores of 0.1 or greater indicated a notable difference.

Analysis of the Data

Data from the Kolb's LSI yielded identify learning styles. The researcher determined the frequencies for each learners to then describe the learning style of the participants as a whole.

The rating data from the Learning Questionnaires were analyzed using non-para matrix descriptive statistics. Frequencies and percentages were used to describe the learners' characteristics for the participants as a group. Means were calculated to determine the degree of like or dislike the participant reported for each Instructional Strategies as a group.

Qualitative analysis of the data from the three open-ended questions yielded particular themes of responses. This analysis also revealed common or unique responses. Comparison between the learners' characteristics, learning styles, and Instructional Strategies preference findings were then made to reach conclusion and recommendation for practice and further research.

CHAPTER IV

FINDINGS

The researcher analyzed the gathered data and reports the findings of this study in Chapter IV.

The researcher first reports the demographic d ata that describes the characteristics of the participants of this study in relation of their degree of like or dislike for Instructional Strategies of the Cisco Networking CBT program. The findings regarding the overall mean scores for the two instructional categories of interactive and non-interactive are presented. The researcher then reports the findings from both the Kolb's LSI and the Learning Questionnaire. Findings of statistical comparison of data from the Kolb's LSI and the Learning Questionnaire are then reported. Finally, the researcher reports the qualitative findings of this study.

Two instruments were used in this study: The Learning Questionnaire and the Kolb's LSI.

The Learning Questionnaire is divided into three parts. The first part asked for participants' demographic data. In the second part of the Learning Questionnaire the participants indicated their preferences toward each Instructional Strategy on a Likert type scale. The third section contains three open-ended questions which sought to gain personal responses about Instructional Strategies.

The Kolb's LSI determine the participants' learning styles. When the AC/CE and

AE/RO combination scores for each participant were plotted on the learning style grid, an

individual's learning style was determined.

After the researcher identified the participants' learning styles, the relationship

between participant's different learning styles and their preferences toward different

Instructional Strategies were determined.

Both instruments were given to 83 participants. The researcher received

completed instruments from 55 participants. Among the 55 completed surveys, one

survey appeared to be biased, the respondent selected Strongly Dislike to all instructional

strategies and did not answer the three open-ended questions, and thus was not reasonable

data to include as part of the research. Eleven of the 54 completed LSI instruments were

either incomplete or incorrect. Therefore, the data for these 11 participants were not

included. The data reflects a total of 43 of the 54 participants.

Part I-Quantitative Data Findings

Genders

Table 1 Mean Scores for Each Instructional Strategy by Genders

Instructional Strategies	Male (N=46) (Mean)	Female (N=8) (Mean)
6	3.73	3.87
7	4.23	4.37
8	4.30	4.50
9	4.02	4.00
10	4.32	4.75
11	4.47	4.37
12	3.65	3.50
13	3.82	3.87
14	3.67	3.87
15	3.93	3.87
16	3.82	3.87
17	4.30	4.50
18	3.82	3.75
19	3.82	4.12
20	3.97	4.25
21	4.10	4.00
22	3.69	3.12
23	4.15	4.25
24	4.28	4.62

- 6= The interactive review questions that I answer before starting a new chapter.
- 7= Access additional information outside of the curriculum via Web links.
- 8= The troubleshooting simulation exercises in Labs.
- 9= Work in teams.
- 10= The guided learning activities in Labs.
- 11= The simulation exercises.
- 12= The drag and drop activities.
- 13= The mathematical activities.
- 14= Matching words and definitions.
- 15= Replay, zoom in, move around a graphic or control animations.
- 16= Control the slides.
- 17= The interactive quiz questions that I answer after completing the chapter.
- 18= The texts in the Content Display area.
- 19= The analogies.

- 20= The texts are easy to read.
- 21= The slides that accompany with the content.
- 22= The audio files.
- 23= The graphics, charts, and photographic used to illustrate the content.
- 24= The example exercises.

The findings reported in Table one showed that the instructional strategies in the program were all favorably liked by both male and female respondents. None of the strategies received a mean score below 3.12.

Among all Instructional Strategies, male respondents most liked Instructional Strategies 11 (The simulation exercises), 10 (The guided learning activities in Labs), 8 (The troubleshooting simulation exercises in Labs), and 17 (The interactive quiz questions that I answer after completing the chapter). They least liked Instructional Strategies 12 (The drag and drop activities), 14 (Matching words and definitions), and 22 (The audio files). Among all the interactive strategies, male respondents most liked strategies 11 (The simulation exercises), 10 (The guided learning activities in Labs), 8, (The troubleshooting simulation exercises in Labs), and 17 (The interactive quiz questions that I answer after completing the chapter). They least liked strategies 12 (The drag and drop activities), 14 (Matching words and definitions), and 6 (The interactive review questions that I answer before starting a new chapter). Among all the non-interactive strategies, males most liked strategies 24 (The example exercises), 23 (The graphics, charts, and photographic used to illustrate the content), and 21 (The slides that accompany with the content). They least liked strategies 22 (The audio files), 18 (The texts in the Content Display area), and 19 (The analogies).

Strategies 10 (The guided learning activities in Labs), 24 (The example exercises), 8 (The troubleshooting simulation exercises in Labs), and 17 (The interactive

quiz questions that I answer after completing the chapter) of all the strategies received the

highest mean scores from female respondents while strategies 22 (The audio files), 12

(The drag and drop activities), and 18 (The texts in the Content Display area) received the

lowest mean scores. Among all interactive strategies, female respondents liked strategies

10 (The guided learning activities in Labs), 8 (The troubleshooting simulation exercises

in Labs), 17 (The interactive quiz questions that I answer after completing the chapter),

and 11 (The simulation exercises) most. Strategies 6 (The interactive review questions

that I answer before starting a new chapter), 13 (The mathematical activities), 14

(Matching words and definitions), 15 (Replay, zoom in, move around a graphic or control

animations), and 16 (Control the slides) all received a 3.87 mean score from female

respondents. This score was the lowest mean score among all interactive strategies.

Female respondents most liked strategies 24 (The example exercises), 20 (The texts are

easy to read), and 23 (The graphics, charts, and photographic used to illustrate the

content), and they least liked strategies 22 (The audio files) and 18 (The texts in the

Content Display area) among all non-interactive strategies.

Table 2 Highest rated Instructional Strategies between Genders

	Male	Female	Both M&F
Strategies	11	6	9
	12	7	13
	21	8	15
	22	10	16
		14	18
		17	
		19	
		20	
		23	
		24	

The training program was more appealing to female respondents than to male respondents. Females rated ten out of the nineteen strategies higher when compared to male ratings. Male respondents only rated four of the strategies higher in comparison to female ratings. Strategies that were rated highly by male respondents were strategies 9 (Work in teams), 11 (The simulation exercises), 12 (The drag and drop activities), 13 (The mathematical activities), 15 (Replay, zoom in, move around a graphic or control animations), 16 (Control the slides), 18 (The texts in the Content Display area), 21 (The slides that accompany with the content), and 22 (The audio files). Female respondents highly rated strategies 6 (The interactive review questions that I answer before starting a new chapter), 7 (Access additional information outside of the curriculum via Web links), 8 (The troubleshooting simulation exercises in Labs), 9 (Work in teams), 10 (The guided learning activities in Labs), 13 (The mathematical activities), 14 (Matching words and definitions), 15 (Replay, zoom in, move around a graphic or control animations), 16 (Control the slides), 17 (The interactive quiz questions that I answer after completing the chapter), 18 (The texts in the Content Display area), 19 (The analogies), 20 (The texts are easy to read), 23 (The graphics, charts, and photographic used to illustrate the content), and 24 (The example exercises) the highest. The mean scores for five strategies had no notable differences between males and females. These strategies were 9 (Work in teams), 13 (The mathematical activities), 15 (Replay, zoom in, move around a graphic or control animations), 16 (Control the slides), and 18 (The texts in the Content Display area).

Table 3 Mean Scores for Each Instructional Strategy by Ages

Instructional Strategies	35 or Younger (N=31) (Mean)	Older than 35 (N=23) (Mean)
6	3.77	3.73
7	4.16	4.39
8	4.35	4.30
9	4.29	3.65
10	4.58	4.13
11	4.51	4.39
12	3.54	3.73
13	3.67	4.04
14	3.54	3.91
15	4.06	3.73
16	3.87	3.78
17	4.35	4.30
18	3.90	3.69
19	3.93	3.78
20	4.06	3.95
21	4.22	3.91
22	3.61	3.60
23	4.29	4.00
24	4.35	4.30

Respondents in all age groups liked instructional strategies in the program. None of the strategies received a mean score below 3.54.

Among all strategies, respondents who were 35 years old or younger most liked Instructional Strategies 10 (The guided learning activities in Labs), 11 (The simulation exercises), 8 (The troubleshooting simulation exercises in Labs), 17 (The interactive quiz questions that I answer after completing the chapter), and 24 (The example exercises). They least liked Instructional Strategies 12 (The drag and drop activities), 14 (Matching words and definitions), 13 (The mathematical activities), and 22 (The audio files). Among all the interactive strategies, respondents who were 35 years old or younger most

liked strategies 10 (The guided learning activities in Labs), 11 (The simulation exercises), 8 (The troubleshooting simulation exercises in Labs), and 17 (The interactive quiz questions that I answer after completing the chapter). They least liked strategies 12 (The drag and drop activities), 14 (Matching words and definitions), 13 (The mathematical activities), and 6 (The interactive review questions that I answer before starting a new chapter). Among all the non-interactive strategies, those who were 35 or younger most liked strategies 24 (The example exercises), 23 (The graphics, charts, and photographic used to illustrate the content), and 21 (The slides that accompany with the content). They least liked strategies 22 (The audio files), 18 (The texts in the Content Display area), and 19 (The analogies).

Strategies 7 (Access additional information outside of the curriculum via Web links), 11 (The simulation exercises), 8 (The troubleshooting simulation exercises in Labs), 17 (The interactive quiz questions that I answer after completing the chapter), and 24 (The example exercises) of all the strategies received the highest mean scores from respondents who were older than 35 while strategies 22 (The audio files), 9 (Work in teams), and 18 (The texts in the Content Display area) received the lowest mean scores from them. Among all interactive strategies, respondents who were older than 35 liked strategies 7 (Access additional information outside of the curriculum via Web links), 11 (The simulation exercises), 8 (The troubleshooting simulation exercises in Labs), and 17 (The interactive quiz questions that I answer after completing the chapter) most. Strategies 9 (Work in teams), 6 (The interactive review questions that I answer before starting a new chapter), 12 (The drag and drop activities), and 15 (Replay, zoom in, move around a graphic or control animations) were least liked by respondents who were older

46

than 35. They most liked strategies 24 (The example exercises) and 23 (The graphics,

charts, and photographic used to illustrate the content), and they least liked strategies 22

(The audio files), 18 (The texts in the Content Display area), and 19 (The analogies)

among all non-interactive strategies.

Table 4 Highest rated Instructional Strategies between Ages

	35 or Younger	Older than 35	All Ages
Strategies	9	7	6
	10	12	8
	11	13	16
	15	14	17
	18		22
	19		24
	20		
	21		
	23		

The training program was more appealing to respondents who were 35 years old

or younger than respondents who were older than 35. Respondents who were 35 years

old or younger rated nine out of the nineteen strategies higher than respondents who were

older than 35. Respondents who were older than 35 only rated four of the strategies

higher than respondents who were 35 or younger. Strategies that were rated the highest

by respondents who were 35 years old or younger were strategies 9 (Work in teams), 10

(The guided learning activities in Labs), 11 (The simulation exercises), 15 (Replay, zoom

in, move around a graphic or control animations), 18 (The texts in the Content Display

area), 19 (The analogies), 20 (The texts are easy to read), 21 (The slides that accompany

with the content), and 23 (The graphics, charts, and photographic used to illustrate the

content). Respondents who were older than 35 rated strategies 7 (Access additional

information outside of the curriculum via Web links), 12 (The drag and drop activities),

13 (The mathematical activities), and 24 (The example exercises) the highest. There

were no notable differences between the mean score of both age groups for strategies 6

(The interactive review questions that I answer before starting a new chapter), 8 (The

troubleshooting simulation exercises in Labs), 16 (Control the slides), 17 (The interactive

quiz questions that I answer after completing the chapter), 22 (The audio files), and 24

(The example exercises).

Educational Level

Table 5 Mean Scores for Each Instructional Strategy between Educational Levels

Instructional Strategy	College or Below (N=40) (Mean)	Above College (N=14) (Mean)
6	3.82	3.57
7	4.32	4.07
8	4.40	4.14
9	3.97	4.14
10	4.37	4.42
11	4.62	4.00
12	3.72	3.35
13	3.85	3.78
14	3.75	3.57
15	4.00	3.71
16	3.85	3.78
17	4.30	4.42
18	3.77	3.92
19	3.87	3.85
20	3.95	4.21
21	4.05	4.21
22	3.60	3.64
23	4.10	4.35
24	4.35	4.28

Respondents in all educational levels liked all the instructional strategies in the

program. None of the strategies received a mean score below 3.35.

Among all Instructional Strategies, respondents with a college degree or below most liked Instructional Strategies 11 (The simulation exercises), 8 (The troubleshooting simulation exercises in Labs), and 24 (The example exercises). They least liked Instructional Strategies 22 (The audio files), 12 (The drag and drop activities), and 14 (Matching words and definitions). Among all the interactive strategies, respondents with a college degree or below most liked strategies 11 (The simulation exercises), 8 (The troubleshooting simulation exercises in Labs), and 10 (The guided learning activities in Labs). They least liked strategies 12 (The drag and drop activities), 14 (Matching words and definitions), and 6 (The interactive review questions that I answer before starting a new chapter). Among all the non-interactive strategies, they most liked strategies 24 (The example exercises), 23 (The graphics, charts, and photographic used to illustrate the content), and 21 (The slides that accompany with the content). They least liked strategies 22 (The audio files), 18 (The texts in the Content Display area), and 19 (The analogies).

Strategies 10 (The guided learning activities in Labs), 17 (The interactive quiz questions that I answer after completing the chapter), 23 (The graphics, charts, and photographic used to illustrate the content), and 24 (The example exercises) of all the strategies received the highest mean scores from respondents with advanced education while strategies 12 (The drag and drop activities), 6 (The interactive review questions that I answer before starting a new chapter), 14 (Matching words and definitions), and 15 (Replay, zoom in, move around a graphic or control animations) received the lowest mean scores from them. Among all interactive strategies, respondents with advanced education liked strategies 10 (The guided learning activities in Labs), 17 (The interactive quiz questions that I answer after completing the chapter), 8 (The troubleshooting

simulation exercises in Labs), and 9 (Work in teams) most. Strategies 12 (The drag and

drop activities), 6 (The interactive review questions that I answer before starting a new

chapter), 14 (Matching words and definitions), and 15 (Replay, zoom in, move around a

graphic or control animations) were least liked by respondents with advanced education.

They most liked strategies 23 (The graphics, charts, and photographic used to illustrate

the content), 24 (The example exercises), 20 (The texts are easy to read), and 21(The

slides that accompany with the content) and they least liked strategies 22 (The audio

files), 19 (The analogies), and 18 (The texts in the Content Display area) among all non-

interactive strategies.

Table 6 Highest rated Instructional Strategies between Educational Levels

	College or Below	Above College	All Ed. Levels
Strategies	6	9	10
	7	17	13
	8	18	16
	11	20	19
	12	21	22
	14	23	24
	15		

The training program was more appealing to respondents with a college degree or

below than respondents with advanced education. Respondents with a college degree or

below rated seven out of the nineteen strategies higher than those with advanced degree.

Respondents with advanced education rated six of the strategies higher than those with a

college degree or less. Strategies that were rated the highest by respondents with a

college degree or below were strategies 6 (The interactive review questions that I answer

before starting a new chapter), 7 (Access additional information outside of the curriculum

via Web links), 8 (The troubleshooting simulation exercises in Labs), 11 (The simulation

exercises), 12 (The drag and drop activities), 14 (Matching words and definitions), and 15

(Replay, zoom in, move around a graphic or control animations). Respondents with

advanced education rated strategies 9 (Work in teams), 17 (The interactive quiz questions

that I answer after completing the chapter), 18 (The texts in the Content Display area), 20

(The texts are easy to read), 21 (The slides that accompany with the content, and 23 (The

graphics, charts, and photographic used to illustrate the content) the highest. The mean

scores for six strategies had no notable differences between educational levels. These

strategies were 10 (The guided learning activities in Labs), 13 (The mathematical

activities), 16 (Control the slides), 19 (The analogies), 22 (The audio files), and 24 (The

example exercises)

.

Table 7 Mean Scores for Each Instructional Strategy by Ethnicity

Instructional Strategies	White (N=20) (Mean)	Minority (N=34) (Mean)
6	3.60	3.85
7	4.15	4.32
8	4.35	4.32
9	4.30	3.85
10	4.35	4.41
11	4.40	4.50
12	3.65	3.61
13	3.45	4.05
14	3.50	3.82
15	4.05	3.85
16	4.05	3.70
17	4.20	4.41
18	3.75	3.85
19	3.70	3.97
20	3.85	4.11
21	4.10	4.08
22	3.45	3.70
23	4.10	4.20
24	4.20	4.41

Both white and minority respondents liked all the instructional strategies in the program. None of the strategies received a mean score below 3.45.

Among all Instructional Strategies, white respondents most liked Instructional Strategies 11 (The simulation exercises), 8 (The troubleshooting simulation exercises in Labs), and 9 (Work in teams). They least liked Instructional Strategies 13 (The mathematical activities), 22 (The audio files), 14 (Matching words and definitions), and 12 (The drag and drop activities). Among all the interactive strategies, white respondents most liked strategies 11 (The simulation exercises), 8 (The troubleshooting simulation exercises in Labs), and 9 (Work in teams). They least liked strategies 13 (The

mathematical activities), 14 (Matching words and definitions), and 12 (The drag and drop activities). Among all the non-interactive strategies, they most liked strategies 24 (The example exercises), 21 (The slides that accompany with the content), and 23 (The graphics, charts, and photographic used to illustrate the content). They least liked strategies 22 (The audio files), 19 (The analogies), and 18 (The texts in the Content Display area).

Strategies 11 (The simulation exercises), 10 (The guided learning activities in Labs), 17 (The interactive quiz questions that I answer after completing the chapter), and 24 (The example exercises) of all the strategies received the highest mean scores from minority respondents while strategies 12 (The drag and drop activities), 6 (The interactive review questions that I answer before starting a new chapter), 14 (Matching words and definitions), and 15 (Replay, zoom in, move around a graphic or control animations) received the lowest mean scores from them. Among all interactive strategies, minority respondents liked strategies 11 (The simulation exercises), 10 (The guided learning activities in Labs), 17 (The interactive quiz questions that I answer after completing the chapter), 7 (Access additional information outside of the curriculum via Web links), and 8 (The troubleshooting simulation exercises in Labs) most. Strategies 12 (The drag and drop activities), 16 (Control the slides), and 14 (Matching words and definitions)were least liked by minority respondents. They most liked strategies 24 (The example exercises), 23 (The graphics, charts, and photographic used to illustrate the content), and 20 (The texts are easy to read) and they least liked strategies 22 (The audio files), 18 (The texts in the Content Display area), and 19 (The analogies) among all non-interactive strategies.

Table 8 Highest rated Instructional Strategies between Ethnicities

	White	**Minority**	**Both White and Minority**
Strategies	9	6	8
	15	7	10
	16	11	12
		13	21
		14	
		17	
		18	
		19	
		20	
		22	
		23	
		24	

The training program was more appealing to minority respondents than white respondents. Minority respondents rated twelve out of the nineteen strategies higher than white respondents. White respondents rated three of the strategies higher than minority respondents. Strategies that were rated the highest by minority respondents were strategies 6 (The interactive review questions that I answer before starting a new chapter), 7 (Access additional information outside of the curriculum via Web links), 11 (The simulation exercises), 13 (The mathematical activities), 14 (Matching words and definitions), 17 (The interactive quiz questions that I answer after completing the chapter), 18 (The texts in the Content Display area), 19 (The analogies), 20 (The texts are easy to read), 22 (The audio files), 23 (The graphics, charts, and photographic used to illustrate the content), and 24 (The example exercises). White respondents rated strategies 9 (Work in teams), 15 (Replay, zoom in, move around a graphic or control animations), and 16 (Control the slides) the highest. The mean scores for five strategies had no notable differences between white and minority respondents.

CCNA Semester

Table 9 Mean Scores for Each Instructional Strategy by the CCNA Semester

Instructional Strategies	Semester 1 (N=35) (Mean)	Semesters 2,3,4 (N=19) (Mean)
6	3.85	3.57
7	4.20	4.36
8	4.31	4.36
9	4.05	3.94
10	4.45	4.26
11	4.45	4.47
12	3.54	3.57
13	3.97	3.57
14	3.77	3.57
15	3.85	4.05
16	3.74	4.00
17	4.40	4.21
18	3.82	3.78
19	4.02	3.57
20	4.22	3.63
21	4.14	4.00
22	3.57	3.68
23	4.28	3.94
24	4.40	4.21

Respondents in all Cisco Certified Network Associate (CCNA) semesters liked all the instructional strategies in the program. None of the strategies received a mean score below 3.54.

Among all Instructional Strategies, respondents in semester 1 most liked Instructional Strategies 10 (The guided learning activities in Labs), 11 (The simulation exercises), 24 (The example exercises), and 17 (The interactive quiz questions that I answer after completing the chapter). They least liked Instructional Strategies 12 (The drag and drop activities), 22 (The audio files), and 16 (Control the slides). Among all the interactive strategies, respondents in semester 1 most liked strategies 10 (The guided

learning activities in Labs), 11 (The simulation exercises), 17 (The interactive quiz questions that I answer after completing the chapter), and 8 (The troubleshooting simulation exercises in Labs). They least liked strategies 12 (The drag and drop activities), 16 (Control the slides), and 14 (Matching words and definitions). Among all the non-interactive strategies, they most liked strategies 24 (The example exercises), 23 (The graphics, charts, and photographic used to illustrate the content), and 20 (The texts are easy to read). They least liked strategies 22 (The audio files) and 18 (The texts in the Content Display area).

Strategies 11 (The simulation exercises), 7 (Access additional information outside of the curriculum via Web links), 8 (The troubleshooting simulation exercises in Labs), and 10 (The guided learning activities in Labs) of all the strategies received the highest mean scores from respondents in semesters 2, 3, and 4 while strategies 6 (The interactive review questions that I answer before starting a new chapter), 12 (The drag and drop activities), 13 (The mathematical activities), 14 (Matching words and definitions), and 19 (The analogies) received the lowest mean scores from them. Among all interactive strategies, respondents in semesters 2, 3, and 4 liked strategies 11 (The simulation exercises), 7 (Access additional information outside of the curriculum via Web links), 8 (The troubleshooting simulation exercises in Labs), and 10 (The guided learning activities in Labs) most. Strategies 6 (The interactive review questions that I answer before starting a new chapter), 12 (The drag and drop activities), 13 (The mathematical activities), and 14 (Matching words and definitions) were least liked by respondents in semesters 2, 3, and 4. They most liked strategies 24 (The example exercises) and 21 (The slides that accompany with the content) and they least liked strategies 19 (The analogies),

20 (The texts are easy to read), and 22 (The audio files) among all non-interactive

strategies.

Table 10 Highest rated Instructional Strategies between CCNA Semesters

	Semester 1	Semesters 2,3,4	All Semesters
Strategies	6	7	8
	9	22	11
	10		12
	13		15
	14		16
	17		18
	20		19
	21		
	23		
	24		

The training program was more appealing to respondents in CCNA semester 1

than respondents in CCNA semesters 2, 3, and 4. Respondents in CCNA semester 1

rated ten out of the nineteen strategies higher than respondents in CCNA semesters 2, 3,

and 4.   Respondents in CCNA semesters 2, 3, and 4 rated two of the strategies higher

than respondents in CCNA semester 1. Strategies that were rated the highest by

respondents in CCNA semester 1 were strategies 6 (The interactive review questions that

I answer before starting a new chapter), 9 (Work in teams), 10 (The guided learning

activities in Labs), 13 (The mathematical activities), 14 (Matching words and

definitions), 17 (The interactive quiz questions that I answer after completing the

chapter), 20 (The texts are easy to read), 21 (The slides that accompany with the content),

23 (The graphics, charts, and photographic used to illustrate the content), and 24 (The

example exercises). Respondents in CCNA semesters 2, 3, and 4 rated strategies 7

(Access additional information outside of the curriculum via Web links) and 22 (The

audio files) the highest. The mean scores for seven strategies had no notable differences between CCNA semesters. These seven strategies rated the highest by respondents in all CCNA semesters were 8 (The troubleshooting simulation exercises in Labs), 11 (The simulation exercises), 12 (The drag and drop activities), 15 (Replay, zoom in, move around a graphic or control animations), 16 (Control the slides), 18 (The texts in the Content Display area), and 21 (The slides that accompany with the content).

Learning Styles

Table 11 Learning Style Distribution Table

Learning Style

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Accommodator	9	16.7	20.9	20.9
	Diverger	7	13.0	16.3	37.2
	Converger	14	25.9	32.6	69.8
	Assimilator	13	24.1	30.2	100.0
	Total	43	79.6	100.0	
Incorrect	Incorrect data	11	20.4		
	Total	11	20.4		
Total		54	100.0		

Table 11 shows the frequency distributions of valid participants' learning styles.

The results from the Kolb's LSI instrument revealed that there were nine (20.9%) Accommodators, seven (16.3%) Divergers, 14 (32.6%) Convergers, and 13 (30.2%) Assimilators.

Figure 1 shows the distribution of participants' learning style.

Figure 1 Learning Style Type Grid
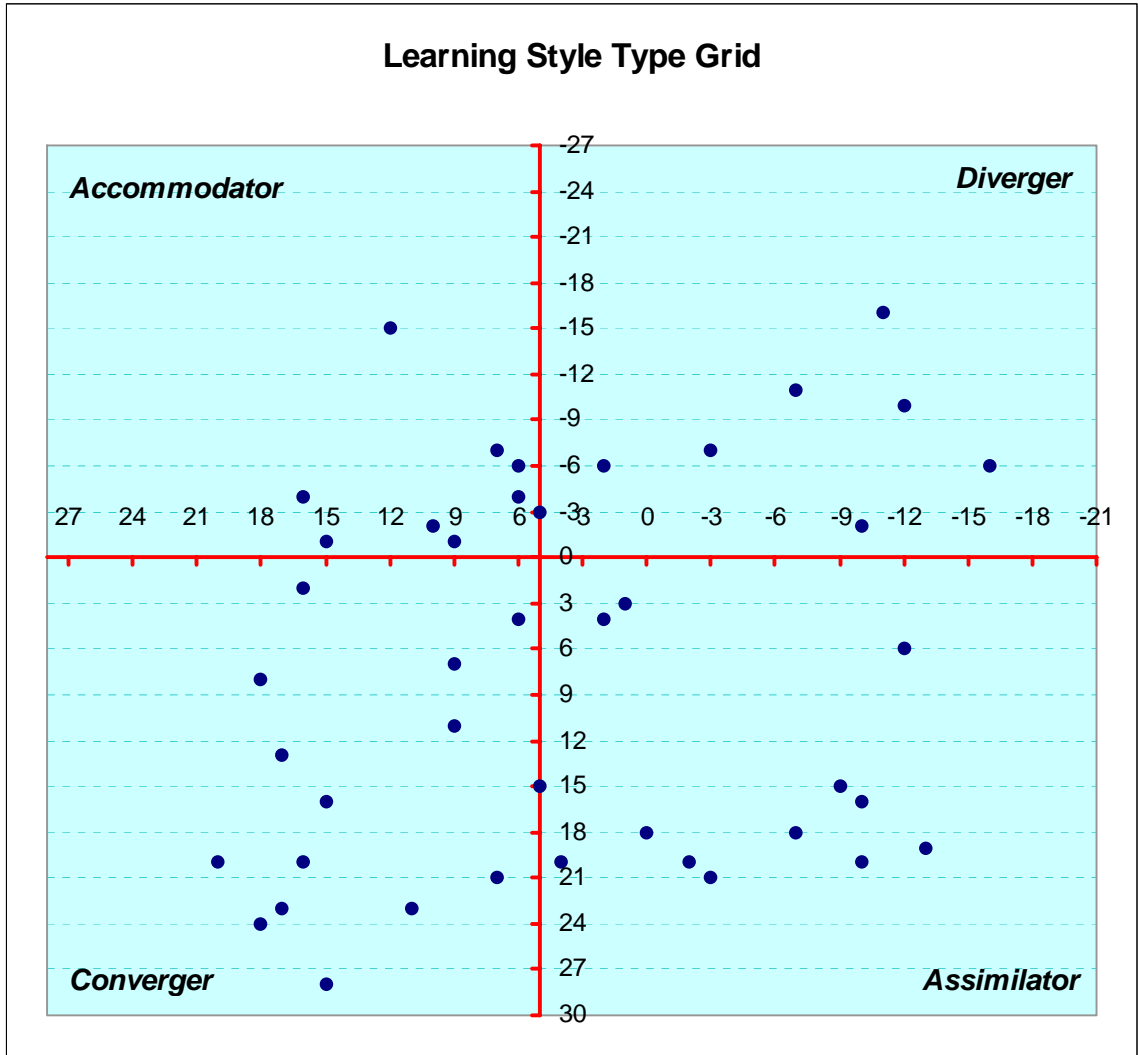
Table 12 Mean Scores for Each Instructional Strategy by Learning Styles

Instructional Strategies	Accommodator (N=9) (Mean)	Diverger (N=7) (Mean)	Converger (N=14) (Mean)	Assimilator (N=13) (Mean)
6	4.33	3.29	3.43	3.77
7	4.33	4.57	4.14	4.08
8	4.56	4.29	4.43	4.00
9	4.22	3.86	3.86	3.62
10	4.67	4.43	4.29	4.31
11	4.78	4.29	4.36	4.46
12	3.33	3.43	3.71	3.54
13	3.67	3.43	3.93	3.77
14	3.33	3.71	3.79	3.62
15	4.78	3.71	3.71	3.62
16	4.22	4.00	3.50	3.62
17	4.44	3.57	4.43	4.23
18	3.78	3.78	3.86	3.54
19	4.44	4.44	3.57	3.69
20	4.56	4.56	3.93	3.69
21	4.67	4.67	3.64	3.92
22	3.78	3.78	3.21	3.54
23	4.33	4.33	4.00	4.00
24	4.56	4.56	4.29	4.31

Among all Instructional Strategies, 14 strategies, strategies 6 (The interactive review questions that I answer before starting a new chapter), 7 (Access additional information outside of the curriculum via Web links), 8 (The troubleshooting simulation exercises in Labs), 9 (Work in teams), 10 (The guided learning activities in Labs), 11(The simulation exercises), 15 (Replay, zoom in, move around a graphic or control animations), 16 (Control the slides), 17 (The interactive quiz questions that I answer after completing the chapter), 19 (The analogies), 20 (The texts are easy to read), 21 (The slides that accompany with the content), 23 (The graphics, charts, and photographic used to illustrate the content, and 24 (The example exercises) all received mean scores above the benchmark mean score of 4.0 from Accommodators. Divergers gave seven strategies,

7 (Access additional information outside of the curriculum via Web links), 8 (The troubleshooting simulation exercises in Labs), 10 (The guided learning activities in Labs), 11 (The simulation exercises), 16 (Control the slides), 23 (The graphics, charts, and photographic used to illustrate the content), and 24 (The example exercises) mean scores either equal or higher than the benchmark mean of 4.0. Seven strategies, 7 (Access additional information outside of the curriculum via Web links), 8 (The troubleshooting simulation exercises in Labs), 10 (The guided learning activities in Labs), 11 (The simulation exercises), 17 (The interactive quiz questions that I answer after completing the chapter), 23 (The graphics, charts, and photographic used to illustrate the content), and 24 (The example exercises) all received mean scores either equal to or above the 4.0 benchmark mean from Convergers. Assimilators gave seven strategies, 7 (Access additional information outside of the curriculum via Web links), 8 (The troubleshooting simulation exercises in Labs), 10 (The guided learning activities in Labs), 11 (The simulation exercises), 17 (The interactive quiz questions that I answer after completing the chapter), 23 (The graphics, charts, and photographic used to illustrate the content), and 24 (The example exercises) mean scores either equal to or higher than the benchmark mean of 4.0. Six strategies, 7 (Access additional information outside of the curriculum via Web links), 8 (The troubleshooting simulation exercises in Labs), 10 (The guided learning activities in Labs), 11 (The simulation exercises), 23 (The graphics, charts, and photographic used to illustrate the content), and 24 (The example exercises) received mean scores above the benchmark mean of 4.0 from all four learning styles of respondents. The findings revealed that these strategies were favorably perceived by all four learning styles of respondents.

Among all Instructional Strategies, strategies 12 (The drag and drop activities), 13 (The mathematical activities), 14 (Matching words and definitions), 18 (The texts in the Content Display area), and 22 (The audio files) received mean scores below 4.0 from Accommodators. Divergers gave strategies 6 (The interactive review questions that I answer before starting a new chapter), 9 (Work in teams), 12 (The drag and drop activities), 13 (The mathematical activities), 14 (Matching words and definitions), 15 (Replay, zoom in, move around a graphic or control animations), 17 (The interactive quiz questions that I answer after completing the chapter), 18 (The texts in the Content Display area), 19 (The analogies), 20 (The texts are easy to read), 21 (The slides that accompany with the content), and 22 (The audio files) mean scores below 4.0. Strategies 6 (The interactive review questions that I answer before starting a new chapter), 9 (Work in teams), 12 (The drag and drop activities), 13 (The mathematical activities), 14 (Matching words and definitions), 15 (Replay, zoom in, move around a graphic or control animations), 17 (The interactive quiz questions that I answer after completing the chapter), 18 (The texts in the Content Display area), 19 (The analogies), 20 (The texts are easy to read), 21 (The slides that accompany with the content), and 22 (The audio files) received mean scores below 4.0 from Convergers. Assimilators gave strategies 6 (The interactive review questions that I answer before starting a new chapter), 9 (Work in teams), 12 (The drag and drop activities), 13 (The mathematical activities), 14 (Matching words and definitions), 15 (Replay, zoom in, move around a graphic or control animations), 16 (Control the slides), 18 (The texts in the Content Display area), 19 (The analogies), 20 (The texts are easy to read), 21 (The slides that accompany with the content), and 22 (The audio files) mean scores below 4.0. Strategies 12 (The drag and

drop activities), 13 (The mathematical activities), 14 (Matching words and definitions), 18 (The texts in the Content Display area), and 22 (The audio files) received mean scores below 4.0 from all four learning styles of respondents. The data showed that strategies 12 (The drag and drop activities), 13 (The mathematical activities), 14 (Matching words and definitions), 18 (The texts in the Content Display area), and 22 (The audio files) were not as strongly positively regarded by all four learning styles of respondents as the other Instructional Strategies.

Among all the interactive strategies, Accommodators most liked Instructional Strategies 11 (The simulation exercises), 15 (Replay, zoom in, move around a graphic or control animations), 10 (The guided learning activities in Labs), 8 (The troubleshooting simulation exercises in Labs), and 17 (The interactive quiz questions that I answer after completing the chapter). They least liked Instructional Strategies 12 (The drag and drop activities), 14 (Matching words and definitions), 13 (The mathematical activities), 9 (Work in teams), and 16 (Control the slides). Among all the non-interactive strategies, they most liked strategies 21 (The slides that accompany with the content), 20 (The texts are easy to read), and 24 (The example exercises). They least liked strategies 18 (The texts in the Content Display area) and 22 (The audio files).

Divergers most liked interactive strategies 7 (Access additional information outside of the curriculum via Web links), 10 (The guided learning activities in Labs), 8 (The troubleshooting simulation exercises in Labs), 11 (The simulation exercises), and 16 (Control the slides). They least liked interactive strategies 6 (The interactive review questions that I answer before starting a new chapter), 12 (The drag and drop activities), 13 (The mathematical activities), 17 (The interactive quiz questions that I answer after

completing the chapter), 14 (Matching words and definitions), and 15 (Replay, zoom in, move around a graphic or control animations). Among all the non-interactive strategies, they most liked strategies 23 (The graphics, charts, and photographic used to illustrate the content), 24 (The example exercises), 18 (The texts in the Content Display area), and 21 (The slides that accompany with the content). They least liked non-interactive strategies 22 (The audio files), 19 (The analogies), and 20 (The texts are easy to read).

Convergers most liked interactive strategies 8 (The troubleshooting simulation exercises in Labs), 17 (The interactive quiz questions that I answer after completing the chapter), 11 (The simulation exercises), 10 (The guided learning activities in Labs), and 7 (Access additional information outside of the curriculum via Web links). They least liked interactive strategies 6 (The interactive review questions that I answer before starting a new chapter), 16 (Control the slides), 12 (The drag and drop activities), 15 (Replay, zoom in, move around a graphic or control animations), and 14 (Matching words and definitions). Among all the non-interactive strategies, they most liked strategies 24 (The example exercises), 23 (The graphics, charts, and photographic used to illustrate the content), and 20 (The texts are easy to read). They least liked non-interactive strategies 22 (The audio files), 19 (The analogies), and 21 (The slides that accompany with the content).

Assimilators most liked interactive strategies 11 (The simulation exercises), 10 (The guided learning activities in Labs), 17 (The interactive quiz questions that I answer after completing the chapter), 7 (Access additional information outside of the curriculum via Web links), and 8 (The troubleshooting simulation exercises in Labs). They least liked interactive strategies 12 (The drag and drop activities), 9 (Work in teams), 14

(Matching words and definitions), 15 (Replay, zoom in, move around a graphic or control

animations), and 16 (Control the slides). Among all the non-interactive strategies, they

most liked strategies 24 (The example exercises), 23 (The graphics, charts, and

photographic used to illustrate the content), and 21 (The slides that accompany with the

content). They least liked non-interactive strategies 18 (The texts in the Content Display

area), 22 (The audio files), 19 (The analogies), and 20 (The texts are easy to read).

Table 13 Highest rated Instructional Strategies between Learning Styles

	Accommodators	Divergers	Convergers	Assimilators
Strategies	6	7	12	
	8	14	13	
	9	18	14	
	10		17	
	11		18	
	15			
	16			
	17			
	18			
	19			
	20			
	21			
	22			
	23			
	24			

The training program was much more appealing to Accommodators than to

Divergers, Convergers, and Assimilators. Accommodators rated fifteen out of the

nineteen strategies higher than the other three learning styles. Convergers rated five

strategies higher than the other three learning styles. Divergers rated three strategies

higher than the other three learning styles. Assimilators did not rate any of the nineteen

strategies higher than the other three learning styles. Strategy 14 (Matching words and

definitions) was rated the highest by both Divergers and Convergers while strategy 17

(The interactive quiz questions that I answer after completing the chapter) was rated the

highest by both Accommodators and Convergers

Interactive vs. Non-Interactive Instructional Strategies

Table 14 Overall Mean Scores for All Instructional Strategies

	Interactive Strategies Mean	Non-Interactive Strategies Mean
Total	4.03	3.98

Overall, interactive strategies were more favorably liked by the respondents than

non-interactive strategies. When calculating the mean of means, the mean score of

interactive strategies was 4.03 and the mean score of non-interactive strategies was 3.98.

The mean scores of interactive strategies and non-interactive strategies were close, 4.03

vs. 3.98, which indicated that the respondents did not strongly favored the interactive

strategies over the non-interactive strategies.

Part II – Qualitative Data

This section reports the qualitative data findings from the three open-ended

questions from the Learning Questionnaire.

I. The following is a summary of the responses to Question 25:What instructional

strategies did you like the most in your computer-based training? Why?

Based on the participants' responses to this question, this researcher found the participants valued "Hands-on" activities. The most frequent responses to this question was "Hands-on" activity. Ten participants stated "Hands-on" activities as their favorite instructional strategy. One response indicated that the hands-on activity developed confidence in his/her ability. Another response stated that he/she learned the most from "Hands-on" activities.

Study aids and the layout of the program both received the second most frequent responses to the question. Six responses indicated that study aids such, as quizzes and feedback were helpful. One response stated that he/she liked quizzes because they captured the key points of the training. Another participant liked to receive feedback on which sections to study more. There were also six responses that expressed an appreciation for the layout of the program. One response stressed the chapter outlines helped him/her set up his/her study routine. Another response stated that he/she liked the Power-Point slide deck.

Working in teams and the interactive qualities of the program received the third most frequent responses to the question. Five responses indicated a preference for working in teams. One response stated that he/she liked working in teams, because he/she learned from each team member. Another response indicted that he/she liked team-based activities and projects. Five responses showed an appreciation for the interactive qualities of the program. One response stated that he/she liked interactive video and audio. Another response indicated that he/she favored the interaction within the program.

Direct interaction with the instructor received the fourth most frequent response to the question. Four responses showed that the participants valued the direct interaction with an instructor. One response stated that he/she liked how the instructor taught the class in a friend level. Another response indicated he/she liked the instructor's ability to clearly explain things and maintain his/her attention.

There were three unique responses to this question. One of the responses was syllabus, another response was practical, and the other was the Cisco router (See Appendix D).

II. The following is a summary of the responses to Question 26: What instructional strategies did you dislike the most in your computer-based training? Why?

Unique responses were the most frequent responses to the question. Eight responses were under Unique Responses category. For example, one respondent stated that he/she disliked working in teams. He/she stated that working in teams reduced the individual's hands-on opportunity. Another respondent indicated he/she disliked when there were no lectures.

The second most frequent response to the question was "nothing" that they disliked about the training received. Six respondents answered no to this question which indicated they did not dislike any of the instructional strategy in this training program.

The third most frequent response to the question was respondents felt constricted by a lack of time. Five responses indicated they disliked the pace of this training. One response stated that there was not enough time to complete the work. Another response indicated that too much information was given in too little time.

Both overused and the lengthy nature of the text and technical difficulties were the fourth most frequent response to the question. They both received three responses in this question. One response stated that he/she disliked the long sections of text. Another response indicated that he/she disliked the fact that he/she had to read a lot of text. Among the comments related to dislike for technical difficulties, one respondent stated that he/she did not like the fact that he/she had trouble downloading extra homework from the website. Another respondent did not like the fact that he/she could not print out the outline using a one-step process.

Lack of clarity and organization, inconsistency between the text and the test questions, audio features of the program, and theoretical aspects of the training all received the least frequent responses to this question. Each of these categories received two responses. For the lack of clarity and organization category, one respondent stated that some questions and information were not very clear and another respondent indicated that version 1.0 curriculum was not as organized as the 2.1 or later versions. One response regarding in the inconsistency between the text and the test questions category stated that lots of the test questions were wrong or worded differently from the test. Another respondent in this category indicated his/her frustration with the tests. For the disliked for the audio features of the program category, one respondent stated that he/she did not like to being read to. Another respondent indicated that he/she did not like the sound with the pictures. For the theoretical aspects of the training category, one respondent stated that he/she disliked the theory. Another indicated that he/she disliked the theoretical aspect of the training because he/she had to memorize the theory (See Appendix D).

III. The following is a summary of the responses to Question 27: Please list instructional strategies you want to have in your computer-based training that would help you learn better.

Both the need for contextualized learning and the Unique Response categories were the most frequent responses to the question. Eight responses indicated a need for contextualized learning. One response stated that he/she would like to have more and better simulations. Another response indicated that he/should would like the instructor to lecture on difficult concepts and show how the concepts applied in the real world. Another response stated that he/she would like to have lab-based projects that simulated real world problems. The Unique Responses category also received eight responses. One respondent indicated that he/she would like clear instruction with no acronyms. Another respondent stated that he/she would like the simulation software to be more affordable to the students while another response was "I don't know".

The need for interaction received the second most frequent response. Five responses indicated a need for interaction. One respondent stated that he/she would like to have two-way dialog. Another respondent indicated he/she would like the training to be more interactive.

The need for more "Hands-on" activities was the third most frequent response for the question. Four responses indicated a need for more "Hands-on". One respondent stated that he/she would like more "hands-on" experience while another respondent indicated he/she would like more "hands-on" labs.

The need for increased team work received the fourth most frequent response. Three responses indicated a need for increased team work. One respondent stated that

he/she would like to have more team-based lab exercises while another respondent indicated that he/she would like more group work.

Both the need for study aids and the need for better facilities received the least frequent response to the question. They each had two responses. One respondent stated that he/she would like to have more assignments and answers while another respondent indicated he/she would like to have important terms color highlighted in the training. In the need for better facilities, one respondent stated that he/she would like to have a more update-to-date facility equipped with wireless network. Another respondent indicated that he/she would like to have adequate testing facilities. (See Appendix D).

The overall findings of this study revealed that the CCNA program had more interactive instructional strategies than non-interactive instructional strategies. The CBT strategies were positively regarded by all students. This training program especially appealed to Accommodators, females, respondents who were 35 years old or younger, respondents with a college degree or below, minority respondents, and respondents in Cisco Certified Network Associate (CCNA) semester 1.

CHAPTER V

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

This chapter will summarize the major aspects of this study, conclude the findings, and make recommendations for instructional activities in Computer-Based Technical Training based on adult learning styles, learner characteristics and further research.

Summary

This descriptive study sought to examine the relationship and interaction between adult learners' learning styles, learner characteristics, and their preferred instructional activities within Computer-Based Technical training. To accomplish this, the relationship between the adult learners' learning styles, learner characteristics, and their preferred instructional activities within Computer-Based Technical training was examined using both quantitative and qualitative methods.

The population of this study was trainees who were enrolled in the regular Computer-Based Technical Training Cisco Networking Academy Program at Richland College in Dallas, Texas. All trainees who were enrolled in the summer 2002 semester were solicited to participate in this study. These students were all adult students who were working or aspiring to work in the computer repair industry.

Two instruments used to gather data from the participants were Kolb's Learning-Style Inventory (See Appendix A) and the Learning Questionnaire that was designed by the researcher (See Appendix B). Kolb's LSI was used to identify the participants' learning styles and the Learning Questionnaire was designed to gain insight into trainees' likes and dislikes for different CBT instructional activities. The following were the steps that the researcher used to design the Learning Questionnaire:

1. The researcher reviewed literature and instruments related to learning styles, instructional strategies and activities, and learners' preferences toward different instructional strategies and activities;

2. The researcher reviewed the CBT curriculum of the Cisco Networking Academy program at Richland College and developed a list of categories of instructional strategies and activities utilized;

3. Based on the literature and the instruments reviewed by the researcher and the Cisco curriculum, the researcher designed a questionnaire with a Likert-type scale to indicate the degree of like and dislike for the categories of instructional strategies with three open-ended questions to provide deeper insights about the participants' responses;

4. After initial instrument design, the researcher pilot tested this instrument with Richland College Cisco training instructors to review the readability and content validity of this questionnaire. Cisco training instructors were desirable to serve as the pilot test group due to their expertise in the fields of curriculum design, computer-based training, adult education, technical training, and instructional technology; and

5. The results of the pilot test ended up with no changes to the instrument.

The ratings for each instructional strategy within the Learning Questionnaire were analyzed per gender, age, educational level, ethnicity, CCNA semester, and learning style.

The following research questions guided this study:

1. What were the instructional activities in the Computer-Based Training of the participant program?

2. What were the learning styles of adult learners engaged in using Computer-Based Technical Training?

3. Which CBT instructional activities did participating adult learners like or dislike in their Computer-Based Technical Training?

4. What was the relationship between adult learners' learning styles and their like or dislike toward different instructional activities in their Computer-Based technical training setting?

5. What was the relationship between adult learners' demographic characteristics and their like or dislike toward different instructional activities in their Computer-Based technical training setting?

In the following section, the researcher answers the above five research questions.

Summary of Findings

1. What were the instructional activities in the Computer-Based Training of the participant program?

Nineteen instructional strategies were identified in the Cisco Networking Academy's Computer-Based Technical Training Program. The instructional strategies were categorized into two categories: Interactive Strategies and Non-Interactive Strategies. The following is the list of instructional strategies that were identified in the Cisco Networking Academy's Computer-Based Technical Training Program:

Interactive Strategies

- 6= The interactive review questions that I answer before starting a new chapter.

- 7= Access additional information outside of the curriculum via Web links.

- 8= The troubleshooting simulation exercises in Labs.

- 9= Work in teams.

- 10= The guided learning activities in Labs.

- 11= The simulation exercises.

- 12= The drag and drop activities.

- 13= The mathematical activities.

- 14= Matching words and definitions.

- 15= Replay, zoom in, move around a graphic or control animations.

- 16= Control the slides.

- 17= The interactive quiz questions that I answer after completing the chapter.

Non-Interactive Strategies

- 18= The texts in the Content Display area.

- 19= The analogies.

- 20= The texts are easy to read.

- 21= The slides that accompany with the content.

- 22= The audio files.

- 23= The graphics, charts, and photographic used to illustrate the content.

- 24= The example exercises.

2. What were the learning styles of adult learners engaged in using Computer-Based Technical Training?

Kolb's LSI was given to 83 participants, and the researcher received 55 completed surveys. Among the 55 completed surveys, one survey appeared to be biased and thus was not reasonable data to include as part of the research. Eleven of the 54 completed surveys were either incompletely or incorrectly answered. Therefore, the data from the 11 participants were not utilized. The data used in this study reflects a total of 43 of the 54 participants. The results of the Kolb's LSI instrument revealed nine (20.9%) of the valid participants were Accommodators, seven (16.3%) were Divergers, 14 (32.6%) were Convergers, and 13 (30.2%) were Assimilators.

3. Which CBT instructional activities did participating adult learners like or dislike in their Computer-Based Technical Training?

All of the instructional strategies used in this training were liked by all the respondents. There was no mean score below 3.12. The audio feature received a mean score of 3.12 from female respondents. These data indicated that all strategies were positively regarded by the participants (See Table 1).

Half of the interactive strategies were highly preferred by the respondents while the simulation exercise was the most preferred strategy among all strategies. Knowles

(1980) stated that adult learners were motivated to learn when they saw immediate relevance to their professional or personal life. The finding supported Knowles's statement on adult learners. Simulation exercise provided a real-life situation, which motivated the learners. Drag and drop activity was a less preferred strategy. Knowles stated that adult learners were ready to learn when the learning outcomes would help them effectively cope with a real-life situation. Apparently adult learners could not see how the drag and drop activity would help them in their daily jobs. Therefore, this strategy was less preferred by the adult learners. Among the 12 interactive strategies, half of them received mean scores above 4.0 and half of them received mean score below 4.0. The results showed that the strategies that received mean scores above 4.0 were highly preferred by the participants. Strategy 11 was the interactive strategy that received the highest mean score. Strategy 12 received the lowest mean score among all interactive strategies.

Example exercise was the most preferred strategy among non-interactive strategies while the audio feature was the least preferred among all strategies. Like simulation exercise, example exercise provided a real-life situation, which motivated the learners. Based on Knowles, adult learners wanted to make decision on their learning (1980). Listening to the audio did not give them the opportunity to play an active role in their learning. Therefore, it was a less preferred strategy. Four out of seven non-interactive strategies received mean score above 4.0. The participants highly preferred over half of the non-interactive strategies in this training and they did not strongly dislike any of the non-interactive strategies. Strategy 24 was the non-interactive strategy that

received the highest mean score. Strategy 22 received the lowest mean score among all non-interactive strategies.

The findings indicated that overall neither of the categories of strategies was more preferred by the participants of the study.

Overall, interactive strategies revealed a higher overall mean score than the mean score of non-interactive strategies. These findings indicated that the respondents did not strongly favor the interactive strategies over the non-interactive strategies (See Table 14). These findings do not match Knowles' theory. Adults want to learn actively. The finding shows no difference between interactive and non-interactive strategies.

The following three open-ended questions at the end of the Learning Questionnaire provided personal insights about the participants' responses.

1. What instructional strategies did you like the most in your computer-based training? Why?

2. What instructional strategies did you dislike the most in your computer-based training? Why?

3. Please list instructional strategies you want to have in your computer-based training that would help you learn well.

According to Knowles (1980), respondents wanted to play an active role in their learning. Based on the respondents' answers to the above questions, the researcher found that the respondents valued a "hands-on' approach", appreciated graphical representations, preferred to work in teams, appreciated the interactive qualities of the program, found that the study aids within the program were helpful, appreciated the layout of the program, and valued direct interaction with an instructor.

The respondents suggested adding more "hands-on" activities, team work, more and improved simulations of real life situations, better access to the software, more dialogue with the real people who worked in the field for Question and Answer purpose, study aids that highlighted important terms, more quiz questions, and more assignments.

Regarding how to improve the CBT program, respondents wanted more time to complete their training. They also wanted to remove the audio features and solve the technical difficulties. The participants were also critical of the lack of clarity and organization, disliked the overuse and lengthy nature of the text, felt frustration with the inconsistencies between the text and the test questions, , and disliked the theoretical aspects of the training (See Appendix D).

4. **What was the relationship between adult learners' demographic characteristics and their like or dislike toward different instructional activities in their Computer-Based technical training setting?**

More instructional strategies in this training appealed to female respondents than they were to the male respondents. Female rated ten out of the nineteen strategies the highest while male respondents only rated four of the strategies the highest. The guided learning activities in Labs, the example exercise, the troubleshooting simulation exercises in Labs, and the interactive post-training questions were strategies highly preferred by female respondents. It seems like that females liked learner-centered, problem-centered strategies. The audio feature and the drag and drop activity were among strategies that were less preferred by them. The simulation exercise and the slides that accompany with the content were among the strategies that were highly preferred by male respondents.

Like the female respondents, male respondents less preferred the drag and drop activities. Matching words and definition was another strategy that was less preferred by male respondents. Adult learners could not see the immediate relevance to their life of these strategies. Therefore, they less preferred the strategies. Both genders liked to work in teams. Based on Knowles, adult learners had lots of experience. Working in team encouraged learners to share their knowledge and past experience with each other. It is highly preferred by both genders.

Respondents who were 35 years old or younger liked this training program better than respondents who were older than 35. Respondents who were 35 years old or younger rated nine out of the nineteen strategies the highest while respondents who were older than 35 only rated four of the strategies the highest. This could be that younger respondents grew up with technologies, and they felt more comfortable using Respondents who were 35 years old or younger highly preferred the guided learning activities in labs and the simulation exercises. They less preferred the drag and drop activities and matching words and definition. Besides the simulation exercise, respondents who were older than 35 also highly preferred accessing additional information outside of the curriculum via Web links.

This training program was slightly more appealed to respondents with a college degree or below than respondents with advanced education. Respondents with a college degree or below rated seven out of the nineteen strategies the highest while respondents with advanced education rated six of the strategies the highest. Six strategies rated the highest by respondents in both educational levels. Strategies that were highly preferred by respondents with a college degree or below were the simulation exercises and the

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troubleshooting simulation exercises in labs. Respondents with advanced education highly preferred the guided learning activities in labs and the interactive post-training questions. It seems like respondents with a college degree or below preferred hands-on or problem-centered strategies which reflected Knowles's orientation to learning while respondents with advanced education preferred discovery learning. The audio feature and the drag and drop activities were less preferred strategies by respondents in both educational levels.

The instructional strategies in the training program were much appealed to minority respondents than they were to white respondents. Minority respondents rated twelve out of the nineteen strategies the highest while white respondents rated three of the strategies the highest. Four strategies were rated the highest by both white and minority respondents. Minority respondents highly preferred the simulation exercises, interactive post-training questions, and the example exercises. They less preferred the drag and drop activities, control the slides, and the audio feature. Like minority respondents, white respondents highly preferred the guided learning activities in labs. Both minority and white respondents also highly preferred the troubleshooting simulation exercises in labs. The audio feature and matching words and definitions were strategies that were less preferred by the white respondents.

This training program was much more appealed to respondents in CCNA semester 1 than respondents in CCNA semesters 2, 3, and 4. Respondents in CCNA semester 1 rated ten out of the nineteen strategies the highest while respondents in CCNA semesters 2, 3, and 4 rated two of the strategies the highest. Seven strategies were rated the highest by respondents in all CCNA semesters.

The guided learning activities in labs, the interactive post-training questions, and the example exercises were strategies that were highly preferred by the respondents in CCNA semester 1. They less preferred the audio feature. Respondents in CCNA semesters 2, 3, and 4 highly preferred accessing additional information outside of the curriculum via Web links. The interactive Pre-training questions, the mathematical activities, and matching words and definitions were less preferred by the respondents in CCNA semesters 2, 3, and 4. The simulation exercises and the troubleshooting simulation exercises in labs were highly preferred by respondents in all CCNA semesters.

5. What was the relationship between adult learners' learning styles and their like or dislike toward different instructional activities in their Computer-Based technical training setting?

Instructional strategies used in the training program were much more appealed to Accommodators than to Divergers, Convergers, and Assimilators. Accommodators rated fifteen out of the nineteen strategies the highest while Convergers rated five, Divergers rated three, and Assimilators rated zero of the nineteen strategies the highest.

The findings revealed that strategies 7 (Access additional information outside of the curriculum via Web links), 8 (The troubleshooting simulation exercises in Labs), 10 (The guided learning activities in Labs), and 11 (The simulation exercises) were favorably perceived by all four learning styles of respondents. Kolb stated that Accommodators and Convergers liked to learn from "Hands-on" activities (1985). Both strategies 8 (The troubleshooting simulation exercises in Labs) and 11 (The simulation

exercises) were strongly appealed to all four types of learners while they appealed to Accommodators the most. The findings reflected Kolb's statement.

Kolb's stated Covergers rather deal with technical problems than other people (1985). Based on the findings, interactive strategy 9 (Work in teams) was a less preferred strategy for Convergers.

Assimilators were more interested in abstract ideas and concepts, and were less interested in people (Kolb, 1985). The findings showed that interactive strategy 9 was also a less preferred strategy by Assimilators which reflect Kolb's statement. However, the finding indicated that an analogy was a less preferred strategy by Assimilators.

Kolb stated that Divergers liked to learn via observation and they liked to deal with others (1985). There was no instructional strategy provided observation opportunity to the learners in this program. Based on the finding, interactive strategy 9 was a less preferred strategy by Divergers. The finding didn't reflect Kolb's statement about Divergers.

Strategies 12 (The drag and drop activities), 13 (The mathematical activities) and 14 (Matching words and definitions) were least appealed to all participants by general. Strategies 12 (The drag and drop activities), 13 (The mathematical activities) and 14 (Matching words and definitions) received mean scores below 4.0 from all four learning styles of respondents. The data showed that strategies 12 (The drag and drop activities), 13 (The mathematical activities) and 14 (Matching words and definitions) were not highly preferred by all four learning styles of respondents.

All four types of learner liked to play active roles in their learning. Simulation exercise, troubleshooting simulation exercise and guided-learning activity in labs were

preferred interactive strategies by all type of learners. Interactive post-training test was a preferred interactive strategy by Accommodators, Convergers, and Assimilators but it was less preferred by Divergers. Controlling visual aids feature was a preferred interactive strategy by Accommodators, but it was less preferred by other three types of learners. Drag and drop activity and matching words and definitions were less preferred by all four types of the learners. Mathematical activity was less preferred by Accommodators and Divergers while work in teams was less preferred by Accommodators and Assimilators. Controlling the slides was a preferred interactive strategy by Divergers, but was a less preferred strategy by other three types of learners. Accessing additional information outside of the curriculum via Web links was a preferred strategy by Divergers, Convergers, and Assimilators.

Non-Interactive strategies were more appealed to Accommodators than they were to Divergers, Convergers, and Assimilators.

Visual aids and example exercise were preferred non-interactive strategies by all types of learners. Analogy, reader-friendly text, and slides that accompany with the content were preferred non-interactive strategies by Accommodators, but they were less preferred by Divergers, Convergers, and Assimilators.

The findings revealed that strategies 23 (The graphics, charts, and photographic used to illustrate the content) and 24 (The example exercises) were favorably perceived by all four learning styles of respondents.

The data showed that strategies 18 (The texts in the Content Display area) and 22 (The audio files) were not strongly positive regarded by all four learning styles of respondents. Strategies 19 (The analogies), 20 (The texts are easy to read), and 21 (The

slides that accompany with the content) received mean scores below 4.0 from Divergers, Convergers, and Assimilators which indicated that these three strategies were not strongly positive regarded by respondents of these three learning styles.

There were differences between the mean scores of learning style groups for each strategy. Eight out of 28 differences between the mean scores of learning style groups for each strategy were larger than 1.03. The largest mean score differences were between Accommodators and Convergers for Instructional Strategy 22 (The audio files)(4.67 vs. 3.21, Difference=1.46) (See Table 12).

Instructional strategies in this training program were more appealed to Accommodators than they were to Divergers, Convergers, and Assimilators.

Accessing additional information outside of the curriculum via Web links, troubleshooting simulation exercises in labs, guided-learning activity in labs, simulation exercises, visual aids, and examples exercises were preferred instructional strategies by all four types of learners.

Interactive pre-training questions, working in teams, controlling visual aids, analogy, reader-friendly text, and slides that accompany with the content were instructional strategies that were preferred by Accommodators but less preferred by the other three types of learners.

Controlling the slides was a preferred strategy by Accommodators and Divergers but less preferred by Convergers and Assimilators.

Interactive post-training questions was a preferred strategy by Accommodators, Convergers, and Assimilators but less preferred by Divergers.

Drag and drop activity, mathematical activity, match words and definitions, texts in the Content Display area, and audio feature were instructional strategies that were less preferred by all four types of learners.

There were differences between the mean scores of learning style groups for each instructional strategy. The largest mean score difference were between Accommodators and Convergers for Instructional Strategy 21 (4.67 vs. 3.64, Difference =1.03). The second largest mean score difference were between Accommodators and Divergers for Instructional Strategy 20 (4.56 vs. 3.57, Difference =0.99) (See Table 13). There were no mean score below 3.21 for any of the strategies which showed that none of the strategies was strongly negative perceived by the respondents.

Conclusions

The following conclusions are based on the findings of this research:

1. The Cisco Networking Academy's Computer-Based Technical Training program is more interactive by nature than non-interactive.

2. Based on the sample, it seems that the participants of the CCNA program are fairly equally representative of the four learning styles.

3. Interactive and non-interactive instructional strategies were equally appealing across all four learning styles.

4. Based on both quantitative and qualitative data, instructional strategies that allow students to be actively engaged in the learning are highly preferred.

5. Participants liked the instructional strategies. The items they disliked were more related to the curriculum.

6. Learners' demographic characteristics did make a notable difference regarding the degree of preference for many of the Instructional Strategies.

7. Instructional Strategies of the Cisco program were not equally appealing to all four learning style of learners. The program was more favorable to Accommodators than the other three styles of learners.

8. Based on the qualitative data, the CBT Instructional Strategies that contained the abstract learning activities were most problematic for all four learning styles of learners.

Recommendations

For Practice

Recommendation One

All of the instructional strategies used in the Cisco Networking Academy program were positively regarded by the respondents. Instructional designers should keep incorporating both interactive and non-interactive strategies when designing Computer-Based technical training in the future.

Recommendation Two

Based on Knowles' adult learning theory, adult learners need to know when, why, what, and how are they going to learn. Instructional designers need to make sure to address when, why, what, and how of the learning at the beginning of the training.

Recommendation Three

When designing computer-based technical training, instructional designers should keep in mind that all learners regardless their different learning styles and demographic background want to play active roles in their learning. Learners want to be able to apply

what they have learned. All of the highly preferred strategies were at or above

application level of Bloom's taxonomy (Anderson and Krathwohl, 2001). Instructional

designers also need to know that adult learners are self-directed, have lots of knowledge

and experiences, and enjoy problem-centered learning. Instructional designers should

add more discovery learning, hands-on activities, team-based activities, guided learning

activities, simulation exercises, interactive post-training questions, visual aid such as

slides, graphics, charts and graphics, and example exercises to computer-based technical

training programs.

Discovery learning requires learners to access additional information outside of

the curriculum and draw logical conclusion. Hands-on activities give learners

opportunities to apply what they have learned. Knowles stated adult learners had a

variety of experiences, which provided the basis for learning activities (1980). Team-

based activities allow the learners to learn as a team and from each other. Guided learning

activities provide learners step-by-step instruction on how to apply what they just learned.

Simulation exercises such as Cisco's troubleshooting simulation exercise give learners

opportunities to solve the problems on their own in a simulated environment. Interactive

post-training questions give learners specific feedback which help learners assessing their

level of knowledge and reinforcing learning. Visual aid such as slides, graphics, charts

and graphics are used to illustrate the content could help learners understanding the

content. Like interactive post-training questions, example exercises help learners

checking their knowledge level and reinforcing learning.

<u>Recommendation Four</u>

Some of the participants in the Cisco training program expressed the need to have

dialog with Cisco Certified Network engineer who is doing the tasks daily in the real

world. It is recommended that online office hours via instant messaging software such as Microsoft Network Messenger and Yahoo Messenger, and threaded discussions be incorporated to increase the interaction between the learners, and the instructors and other field experts.

Recommendation Five

The drag and drop activity, audio feature, text in the Content Display Area are common instructional strategies used in computer-based learning. However, these strategies were less appealing to all learners. Adult learners are outcomes-oriented. It is recommended that instructional designers should keep the drag and drop activity, audio feature, and other purely abstract learning activities to a minimum. They should also re-evaluate the length of the training. Instructional designers should also avoid putting too much text in one page. Based on the literature, when developing training programs, instructional designers should create measurable learning objectives, make sure the content meet the objectives and the post-training quiz questions will measure whether the learners have accomplish the objectives. It is also recommended that the study aids that highlighted important terms to help the learners capture key learning points. Additionally, a helpdesk that troubleshoots any technical issues that the learners have should be available 24 hours per day, seven days per week.

Recommendation Six

Instructional designers should keep preferred instructional strategies for each type of learners in mind when designing computer-based technical training programs. Interactive post-training test was a highly preferred strategy by Accommodators, Convergers, and Assimilators but it's a less preferred strategy by Divergers. Controlling visual aids feature was a preferred interactive strategy by Accommodators, but it was less

preferred by other three types of learners. Mathematical activity was less preferred by Accommodators and Divergers while team work was less preferred by Accommodators and Assimilators. Controlling the slides was a preferred interactive strategy by Divergers, but was a less preferred strategy by other three types of learners. Accessing additional information outside of the curriculum via Web links was a preferred strategy by Divergers, Convergers, and Assimilators. Analogy, reader-friendly text, and slides that accompany with the content were preferred non-interactive strategies by Accommodators, but they were less preferred by Divergers, Convergers, and Assimilators. Interactive pre-training questions, working in teams, controlling visual aids, analogy, reader-friendly text, and slides that accompany with the content were instructional strategies that were preferred by Accommodators but less preferred by the other three types of learners. Controlling the slides was a preferred strategy by Accommodators and Divergers but less preferred by Convergers and Assimilators. Interactive post-training questions was a highly preferred strategy by Accommodators, Convergers, and Assimilators but a less preferred by Divergers. Instructional designers should try to use instructional strategies that appeal to all four types of learners when possible. Instructional designers should add instructional strategy such as streaming video that allows observation opportunities for Assimilators and Divergers and add strategies such as "hands-on" activities, problem-based learning, and brainstorming to the training for Assimilators and Convergers. Finally, it is recommended that instructional designers need to include an even distribution of instructional strategies that meet each type of learners' need in the computer-based technical training programs.

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For Further Research

This study was limited by a population of Cisco Networking Academy Program's trainees at Richland College in Dallas, Texas. Further research should be conducted to determine if the results of this study occur with other populations. Possible studies are suggested as follows:

- Continued investigation of the relationship and interaction between adult learners' learning styles, learner characteristics and their preferred instructional activities within other Computer-Based Technical training;

- Study a larger population to see how demographic such as gender and cultural affects learning style preferences.

- More in-depth study to determine whether computer-based technical training is more suitable for Accommodators, Divergers, Convergers, or Assimilators.

- Investigate whether Divergers prefer instructional strategies that allow them to observe in a computer-based technical training program

- Investigate a larger population to determine if there is a particular style of learners who tend to enroll in computer-based technical program.

- Study if different demographical backgrounds impact adult learners' preferences toward computer-based technical training. If demographic background has impact on learners' preferences, investigate why they impact the preferences.

Conclusion

This study investigated the relationship and interaction between adult learners' learning styles, learner characteristics, and their preferred instructional activities within Cisco's Computer-Based Technical training program. All nineteen instructional

strategies identified in the Cisco Networking Academy's Computer-Based Technical Training Program were preferred by all the respondents regardless of their different learning styles and demographic backgrounds. This training program especially appealed to Accommodators, females, respondents who were 35 years old or younger, respondents with a college degree or below, minority respondents, and respondents in Cisco Certified Network Associate (CCNA) semester 1. The program is more interactive by nature than non-interactive. Based on the data, participants preferred instructional strategies such as simulation exercises or guided learning activities that allowed them to be actively engaged in the learning. Non-interactive instructional strategies such as the audio feature and drag and drop activities were least favorably appealing to the respondents. The findings of this study supported Knowles' adult learning principles except that adult learners of this study did not prefer interactive over non-interactive activities and reflected Kolb's statements about Accommodators and Convergers. A set of recommendations for instructional activities in computer-based technical training based on adult learning styles and learner characteristics was created for instructional designers of computer-based technical training. The most important recommendation refers to the finding that this CBT program was more appealing to Accommodators. Instructional designers should include strategies that appeal to all four learning styles of learners.

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APPENDIX A

LEARNING STYLE INVENTORY 1985

1.	When I learn:	____	I like to deal with my feelings	____	I like to watch and listen	____	I like to think about ideas	____	I like to be doing things
2.	I learn best when:	____	I trust my hunches and feelings	____	I listen and watch carefully	____	I rely on logical thinking	____	I work hard to get things done
3.	When I am learning:	____	I have strong feelings and reactions	____	I am quiet and reserved	____	I tend to reason things out	____	I am responsible about things
4.	I learn by:	____	feeling	____	watching	____	thinking	____	doing
5.	When I learn:	____	I am open to new experiences	____	I look at all sides of issues	____	I like to analyze things, break them down into their parts	____	I like to try things out
6.	When I am learning:	____	I am an intuitive person	____	I am an observing person	____	I am a logical person	____	I am an active person
7.	I learn best from:	____	personal relationships	____	observation	____	rational theories	____	a chance to try out and practice
8.	When I learn:	____	I feel personally involved in things	____	I take my time before acting	____	I like ideas and theories	____	I like to see results from my work
9.	I learn best when:	____	I rely on my feelings	____	I rely on my observations	____	I rely on my ideas	____	I can try things out for myself
10.	When I am learning:	____	I am an accepting person	____	I am a reserved person	____	I am a rational person	____	I am a responsible person
11.	When I learn:	____	I get involved	____	I like to observe	____	I evaluate things	____	I like to be active
12.	I learn best when:	____	I am receptive and open-minded	____	I am careful	____	I analyze ideas	____	I am practical
TOTAL the scores from each column		☐	Column 1	☐	Column 2	☐	Column 3	☐	Column 4

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APPENDIX B

LEARNING QUESTIONNAIRE

Learning Questionnaire

The purpose of this Learning Questionnaire is to understand your like or dislike for different instructional activities or instructional strategies in your computer-based training. There is no right or wrong answer to each question. Just answer honestly about how you feel about the different instructional strategies listed in the second section of this questionnaire.

Demographic Information
For each of the following questions, put an X beside the choice that best describes you.

1. Gender: Male _____   Female _____

2. Age: 18-25 _____   26-35 _____   36-45 _____   46-55 _____   56-65 _____
**   Above 66 _____**

3. Educational levels: High school _____   College _____   Graduate school _____   Other _____

4. Ethnicity Background: African American (Black) _____   Caucasian (White) _____
**   Hispanic _____   Native American (American Indian) _____**
**   Asian or Pacific Islander _____   Other _____**

5. The CCNA semester you are in: 1_____   2_____   3_____   4_____

Instructional Activities or Strategies
Following are a number of statements describing your like or dislike for different instructional activities or strategies in the computer-based training. Read each statement and circle whether you strongly like (SL), like (L), are neutral (N), dislike (D), or strongly dislike (SD) that it describes your like or dislike.

Interactive Strategies	Strongly Like (SL)	Like (L)	Neutral (N)	Dislike (D)	Strongly Dislike (SD)
6. The interactive review questions that I answer before starting a new chapter.	SL	L	N	D	SD
7. Access additional information outside of the curriculum via Web links.	SL	L	N	D	SD
8. The troubleshooting simulation exercises in Labs.	SL	L	N	D	SD
9. Work in teams.	SL	L	N	D	SD
10. The guided learning activities in Labs.	SL	L	N	D	SD
11. The simulation exercises.	SL	L	N	D	SD
	Strongly	Like	Neutral	Dislike	Strongly

Interactive Strategies (Cont.)	Like (SL)	(L)	(N)	(D)	Dislike (SD)
12. The drag and drop activities.	SL	L	N	D	SD
13. The mathematical activities	SL	L	N	D	SD
14. Matching words and definitions.	SL	L	N	D	SD
15. Replay, zoom in, move around a graphic or control animations.	SL	L	N	D	SD
16. Control the slides.	SL	L	N	D	SD
17. The interactive quiz questions that I answer after completing the chapter.	SL	L	N	D	SD

Non-Interactive Strategies	Strongly Like (SL)	Like (L)	Neutral (N)	Dislike (D)	Strongly Dislike (SD)
18. The texts in the Content Display area.	SL	L	N	D	SD
19. The analogies.	SL	L	N	D	SD
20. The texts are easy to read.	SL	L	N	D	SD
21. The slides that accompany with the content.	SL	L	N	D	SD
22. The audio files.	SL	L	N	D	SD
23. The graphics, charts, and photographic used to illustrate the content.	SL	L	N	D	SD
24. The example exercises.	SL	L	N	D	SD

25. What instructional strategies did you like the most in your computer-based training? Why?

_____

_____

_____

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26. What instructional strategies did you dislike the most in your computer-based training? Why?

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27. Please list instructional strategies you want to have in your computer-based training that would help you learn better.

_____

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Thank you for your participation!

APPENDIX C

COVER LETTER TO PARTICIPANTS

Date

Dear Sir or Madam:

I am writing to invite you to participate in a doctoral dissertation study at Oklahoma State University. The title of this study is Learning Styles and Preferred Instructional Activities in Computer-Based Technical Training for Adults.

As you may already know, we all learn differently, the purpose of this study is to describe the interaction between adult learners' learning styles and their preferred instructional activities. The outcomes of this study will help instructional designers to develop effective computer-based training in the future. This is an anonymous volunteer-based study. Therefore, no one can identify who you are and you can withdraw from this study anytime you want.

Here is how to participate in this study.

1. Fill out both Kolb's Learning Style Inventory and the Learning Questionnaire. (They are stapled together)
2. Return the stapled questionnaires back to the person you received them from.

If you have any questions regarding this study please contact Wein-Pin Yeh at (405) 748-5868 or Ms. Sharon Bacher, OSU Institutional Review Board Executive Secretary, at (405) 744-5700, 203 Whitehurst, Stillwater, OK 74078.

Thank you for your time and participation. Your participation will add body to the knowledge of computer-based training.

Sincerely

Wein-Pin Yeh
Doctoral Candidate in Occupational and Adult Education
Oklahoma State University

APPENDIX D

PARTICIPANTS' RESPONSES TO THE OPEN-ENDED QUESTIONS (QUESTIONS

25-27 OF THE LEARNING QUESTIONNAIRE)

I. The following are respondents' answers to Question 25:What instructional strategies did you like the most in your computer-based training? Why?

1. The following statements indicate that these respondents value a 'hands-on' approach:

- Hands on labs. One on one with instructor, activities (worksheet or labs) to test and sharpen skills and knowledge. Instructor's ability to explain things clearly, and instructor's ability to maintain my attention.

- Slides and hands on

- More difficult exams, more analogies, and more hands on lab exams.

- Lecture with reinforcement in the Lab. Doing what you have learned.

- Hands on doing the labs. I learned the most from them.

- Real world situations. There is no "textbook" network.

- The simulation-based lab was the feature I liked the best. This was because they allowed me to have a lab experience without actual hardware. Thus, I could do them at work, for example. Aside from this, I strongly believe in "hands on" learning. If you don't do it, type it, cable it, touch it, etc., then you don't learn it no matter how many times you've read it.

- To be able to do the hands-on work in labs.

- Hands on. It develops confidence in my ability.

- Instructor-led discussions/reviews and hands-on labs.

2. The following statements indicate an appreciation for graphical representation:

- Graphical presentation.

- GUI. Graphical User Interface

- Reading over the material and at the same time thinking deeply over what I am learning plus assorting illustrations as seeing how they fit in the learning process.

3. The following responses indicate a preference for working in teams:

- Working in teams. Because we lear4n (learn) from each member of the group.

- The interactive strategies. This provides the forum to share your ideas and learning techniques with others.

- Team-based lab exercises help me to learn from others.

- Team-based activities and projects.

- Teams

4. The following responses indicate an appreciation for the interactive qualities of the program:

- Interactive video and audio. Instructors explanation in details-The analogy and concepts.

- The interactive strategies. This provides the forum to share your ideas and learning techniques with others.

- Interaction with (within) the program.

- More difficult exams, more analogies, and more hands on lab exams.

- Testing/review quiz at end of chapters were nice. Interactive labs were also a plus.

5. The following statements indicate that these respondents find that the study aids within the program are helpful:

- Quizzes. Because they tell you what you need to go over again if you miss questions. They give an idea of most important things in the section.

- Feedback as to what sections to study more.

- Testing/review quiz at end of chapters were nice. Interactive labs were also a plus.

- Challenges. Since challenges are lab-based projects which require student to learn different pieces of a puzzle, and then complete the puzzle. It also enhances students and instructor interaction.

- Repetition.

- More difficult exams, more analogies, and more hands on lab exams.

6. The following responses indicate an appreciation for the layout of the program:

- The power-point slides book. I like it because I can easily go back and read paragraphs and redo extra practice on the screen.

- The chapter outlines, because I'm able to setup my own study routine.

- Being able to get to the curriculum from anywhere.

- One-line access.

- Slides and hands on

- Multiple sources.

7. The following statements indicate that these respondents value direct interaction with an instructor:

- Instructor in action.

- Instructor-led discussions/reviews and hands-on labs.

- They way it was taught (in a friend level).

- Hands on labs. One on one with instructor, activities (worksheet or labs) to test and sharpen skills and knowledge. Instructor's ability to explain things clearly, and instructor's ability to maintain my attention.

8. Unique responses:

- Syllabus.

- Cisco router.

- Practical!

II. The following are respondents' answers to Question 26: What instructional strategies did you dislike the most in your computer-based training? Why?

1. The following statements indicate that respondents found nothing that they disliked about the training:

- None.

- None.

- None of them.

- None.

- None.

- None.

2. The following statements indicate that respondents object to a lack of clarity and organization:

- Some questions and information not very clear.

- The lecture of dis-jointed facts. I learned with version 1.0 curriculum which was not nearly as well organized as 2.1 and later versions.

3. The following statements indicate that respondents dislike the overuse and lengthy nature of the text:

- Long sections of text.

- Too long details. I got distracted.

- Reading a whole lot of text.

4. The following responses indicate frustration with the inconsistencies between the text and the test questions:

- A lot of the test questions were wrong or worded differently from the text. Need to be more straightforward and/or corrected. At times equipment was tight and was tough t be able to get the lab time to complete class/homework/labs.

- The test! They have seen to find trial question, that don't seem important.

5. The following responses indicate a dislike for the audio feature of the program:

- Being read to. I can read the on-line text myself. Don't need to be read to.

- Don't like sound with the pictures. Just didn't do anything for me because I read fine on my own.

6. The following statements indicate that these respondents dislike theoretical aspects of the training:

- Theory

- Theory. Because I had to use memory which made it more difficult.

7. The following statements indicate that these respondents' dislikes stem from a technical difficulty:

- The only thing I didn't like was the fact that I had some trouble when I tried to download some extra homework from the website in other kind of format-PAG to PJG.

- The non-capability to print out the outline using a one-step process. It would just make it easier to manipulate the outline page for my use.

- The non-capability to print out the outline using a one-step process. It would just make it easier to manipulate the outline page for my use.

8. The following statements indicate that these respondents felt constricted by a lack of time:

- Do not like the flex term too short with many labs and many chapter tests can't spend enough time to learn anything.

- Reviewing test. This took too much time.

- Not enough time to complete the work.

- Not given specific questions missed, increase ease of learning, save time.

- Too much info in too little time.

9. Unique Responses

The fact that not one instructor is out in the field doing the job daily.

When there were no lectures.

- A lot of the test questions were wrong or worded differently from the text. Need to be more straightforward and/or corrected. At times equipment was tight and was tough t be able to get the lab time to complete class/homework/labs.

- I hated, abhorred, and totally disliked working in teams. Again, if you don't do it, you don't learn it. Working in teams reduced the opportunities to do this and it allows slackers to just coast!

- When you can't skip an exercise if you want to continue on through the course.

- Some instructors tried to keep class at the same chapter.

- Emphasis on staying in class to do work.

- None of a do-it-yourself, I wish that we would have done more as a class, maybe even use the quizzes at the end of chapter for a class review.

III. The following are respondents' answers to Question 27: Please list instructional strategies you want to have in your computer-based training that would help you learn better.

1. The following responses indicate a need for more 'hands on':

- More hands on experience.

- Interaction, labs-Hands on, Discussion.

- More hands-on and class participative activities. Otherwise, EXCELLENT CLASS!

- More hands on, more group oriented projects, adequate testing facilities.

2. The following responses indicate a need for increased team work:

- Team-based lab exercises, simulation exercises, analogies using in the lectures, quiz after each chapters, animation presentation with audio and video.

- More group work.

- More hands on, more group oriented projects, adequate testing facilities.

3. The following responses indicate a need for contextualized learning:

- Simulation exercises, troubleshooting exercises by simulation. Guided learning activities. Matching words and definitions.

- More simulations and interactive.

- More and better simulations.

- Lab-based projects to simulate real world problems.

- More examples and more movies.

- Instructors that can lecture on difficult concepts and show how they apply in the real world.

- Team-based lab exercises, simulation exercises, analogies using in the lectures, quiz after each chapters, animation presentation with audio and video.

- Practical-oriented teaching. Teachers who don't just teach because the book says so! Teachers who don't just read the textbook for you.

4. The following responses indicate a need for interaction:

- Two-way dialog.

- Email opportunities of real people who work in the field for Q&A purposes.

- Interaction, labs-Hands on, Discussion.

- Make it more interactive

- Practical-oriented teaching. Teachers who don't just teach because the book says so! Teachers who don't just read the textbook for you.

5. The following responses indicate a need for study aids:

- Assignment and answers.

- Colored letters for important terms or highlighted terms. More Quiz questions.

6. The following responses indicate a need for better facilities:

- Equipment more up to date. Wireless networking.

- More hands on, more group oriented projects, adequate testing facilities.

7. Unique Responses:

- Mainly the simulation software portion. If this was available to the student for purchase out a reasonable price. And I (am) referring to the more capable software.

- Info not directed/test not correlated.

- Strategy.

- I don't know.

- A program that was written by someone that speaks English.

- Clear instruction with no acronym.

- Text to match the words.

- Team-based lab exercises, simulation exercises, analogies using in the lectures, quiz after each chapters, animation presentation with audio and video.

APPENDIX E

INSTITUTIONAL REVIEW BOARD APPROVAL

Oklahoma State University
Institutional Review Board

Protocol Expires: 7/6/01

Date : Friday, July 07, 2000   IRB Application No: ED00292

Proposal Title: LEARNING STYLES AND PREFERRED INSTRUCTIONAL ACTIVITIES IN COMPUTER-
BASED TECHNICAL TRAINING FOR ADULTS

Principal
Investigator(s) :

Wein-Pin Yeh   Reynaldo Martinez
13501 Pinehurst Rd.   209 Willard
Oklahoma City, OK 73120   Stillwater, OK 74078

Reviewed and
Processed as: Exempt

Approval Status Recommended by Reviewer(s) : Approved

Signature :

Carol Olson, Director of University Research Compliance   Friday, July 07, 2000
                                                                            Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modifications to the
research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office MUST be
notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt
projects may be reviewed by the full Institutional Review Board.

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Oklahoma State University
Institutional Review Board

Protocol Expires: 7/6/01

Date : Thursday, August 31, 2000   IRB Application No   ED00292

Proposal Title: LEARNING STYLES AND PREFERRED INSTRUCTIONAL ACTIVITIES IN COMPUTER-
BASED TECHNICAL TRAINING FOR ADULTS

Principal
Investigator(s) :

Wein-Pin Yeh   Reynaldo Martinez
13501 Pinehurst Rd.   209 Willard
Oklahoma City, OK 73120   Stillwater, OK 74078

Reviewed
and   Exempt   **Modification**

Approval Status Recommended by Reviewer(s) : Approved

Signature:

Carol Olson, Director of University Research Complian   Thursday, August 31, 2000
                                                                         Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modifications
to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office
MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited
and exempt projects may be reviewed by the full Institutional Review Board.

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Oklahoma State University
Institutional Review Board

Protocol Expires: 7/6/01

Date : Tuesday, July 02, 2002   IRB Application No   ED00292

Proposal Title: LEARNING STYLES AND PREFERRED INSTRUCTIONAL ACTIVITIES IN COMPUTER-
BASED TECHNICAL TRAINING FOR ADULTS

Principal
Investigator(s) :

Wein-Pin Yeh   Reynaldo Martinez
13501 Pinehurst Rd.   209 Willard
Oklahoma City, OK 73120   Stillwater, OK 74078

Reviewed and
Processed as: Exempt

Approval Status Recommended by Reviewer(s) · Approved   **Modification**

Please note that the protocol expires on the following date which is one year from the date of the approval of the original
protocol:

Protocol Expires: 7/6/01

Signature :

Tuesday, July 02, 2002

Carol Olson, Director of University Research Compliance   Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modifications
to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office
MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited
and exempt projects may be reviewed by the full Institutional Review Board.

VITA

Wein-Pin Yeh

Candidate for the Degree of

Doctor of Education

Thesis: LEARNING STYLES, LEARNER CHARACTERISTICS,
                 AND PREFERRED INSTRUCTIONAL ACTIVITIES IN
                 COMPUTER-BASED TECHNICAL TRAINING FOR
                 ADULTS

Major Field: Occupational and Adult Education

Biographical:

Personal Data: Born in Keelung, Taiwan, March 7th, 1972, the daughter of Jyh-Sheng Yeh and Fong-Ling Chen. She, her husband, Yu-Wen Lin, and their daughter, Beatrice Lin, live in Longmont, CO.

Education: Bachelor of Science Degree in Technical Education, specializing in Electrical Engineering. Oklahoma State University, 1996;
Master of Science Degree in Occupational and Adult Education, specializing in Cross-Cultural Training. Oklahoma State University, 1997; Doctor of Education Degree in Occupational and Adult Education, specializing in Instructional Technology. Oklahoma State University, December, 2004.

Professional Experience: eLearning Consultant, Intellinex-an Ernst & Young enterprise, 2000-present.