Learning Spreadsheet Software in the Traditional and Synchronous Modes: A Model and A Pilot Study to Investigate End User's Performance and Satisfaction

Shailendra Palvia

College of Management, Long Island University , C. W **.Post Campus Brookville, NY 11548 (USA)**

Abstract

Organizational learning and use oflS technologies ranked !ifih in a list of20 critical IS management issues in U.S.A (Niederman, et al., 1991, p. 480). A very recent study (Kim and Kim, 1999) ranked organizational learning as 131h and IS Education and Training as 141h most important in a list of 30 issues. Globally, this issue ranked .f!!§! in Hong Kong (Burn et al, 1993); !ifih in Singapore (Rao et al, 1987); and ~ in India (Palvia and Palvia, 1992). Knowledge of and skills in the use of software such as word processing, spreadsheet, and database represent the basic computer literacy requirements for end users. Both academic institutions and corporations have been investing significant time and dollars to provide the necessary education in the use of these software products. This paper articulates fill!! approaches --traditional, asynchronous, delayed, and synchronous --to impart computer software education in a group setting. It then describes instruments developed to measure ~ relatively distinct areas of computer software knowledge and skills --memory recall, critical thinking, and computing literacy. Finally, the paper provides an analysis of data collected to compare and contrast the effectiveness of the traditional and synchronous modes for spreadsheet software (excel) education.

The findings are: (a) the traditional mode does not individually contribute to improving memory recall and recognition, or critical thinking whereas synchronous mode does; (b) both traditional and synchronous approaches individually contribute to improving computing literacy; (c) there is no evidence to suggest that either mode is superior in contributing to these improvements, and (d) the end users find the synchronous mode to be more satisfying than the traditional mode for learning spreadsheet software.

Keywords: IS Education, IS Training Methods (Learning Modes), Traditional Method, Synchronous Method, Bloom's Learning Taxonomy, Memory Recall, Computer Literacy, Computing Literacy, Critical Thinking (Learning Comprehension)

1. INTRODUCTION

A survey of U.S. senior information systems (IS) executives found that "organizational learning and use of IS technologies," ranked .tlfih out of a list of 20 critical IS management issues (Niederman, et al., 1991, p. 480). In the global context, this issue ranked ~ out of a list of 20 critical IS issues facing IS executives in India during 1988 (Palvia and Palvia, 1992); training and education of DP Personnel ranked as the .tlfih most important issue in Singapore around 1987 (Rao et al, 1987); retaining, recruiting, and training was the number one issue for Hong Kong around 1989 (Burn et al, 1993); and recruiting, training, and promoting IS staff ranked as the eighteenth most important issue among 20 critical issues around 1994 in Taiwan (Palvia and Wang, 1995).

Topics covered by an overwhelming majority of computer literacy courses in colleges and universities include word processing, spreadsheet, presentation, and database software. These software applications represent the basic

computer literacy requirements for white-collar end users of today. A survey of knowledge and skills requirements of IS specialists and end-user personnel found that: (a) both IS specialists and end-users are most deficient in the area of "general IS knowledge," (b) people need more "organizational knowledge," and (c) end-users need more knowledge in the use of software packages (Nelson, 1991). Both academic institutions and corporate training centers are spending billions of dollars worldwide to provide the necessary training in the use of these software packages. According to Industry Report on 1997 Training Budgets (Johnston and Lou, 1997), U.S. organizations with 100 or more employees budgeted a total of $58.6 billion for formal training -a 5% increase over the previous year (not adjusting for inflation). The number of software training companies and individual consultants has been increasing exponentially to cater to the unmet demand for training. According to this 1997 Report, 38% of training functions are being designed and developed by outside contractors and 32% of these are delivered by some outside contractors. Given this scenario, academic institutions are increasingly expected to educate their students in these skills. Research that can systematically and scientifically determine cost effective learning approaches for the diverse segments of students graduating each year has the potential of a phenomenal payoff.

Grope and Connolly (1995) emphasized the need to customize the education approach for adults to suit their needs, behavior, and learning styles. These authors articulated ten characteristics of adult learners that differentiate them from traditional **full** time school and college students such as prior knowledge and learning experience, commitment to time management, focus on improving specific skills and proficiencies, active versus passive learning, and length of learning sessions. Angel (1994) emphasized the need for continual training since computer training is evolutionary and not revolutionary. Angel also focused on the importance of universal computer literacy in today's information age and even articulated distinction between "computer literacy," "computing literacy," and "computer utilitarian." Coffee (1992) argued that computer-based training (CBT) cannot replace (can assist) instructor-driven training (IDT) primarily because of the richness of interaction that IDT provides to the students. Davis and Bostrom (1993) found no differences in outcomes (perceived ease of use and correctness of responses in hands-on tasks) related to exploration-based and instroction-based training methods for end users

Before the dawn of computers, the traditional mode of teaching in any field in a classroom setting was lectures by an instructor supplemented by labs, tutorials, and homework assignments. Utilizing this model for end user training, an instructor taught basics of a computer software using chalkboard, handouts, easel board, and overhead transparencies, and students then practiced in a computer laboratory. Following the advancement and sophistication of computers, several alternative avenues for instruction have opened up. Initially, instructors gave demonstration of the salient features of a computer software in class with or without the aid of traditional teaching tools -- chalkboard, easel board, transparencies, handouts. After a demonstration, students would go to the computer labs to practice what they learned. Since late eighties, however, instructors have been utilizing interactive computer labs where students can practice concurrently what the instructor is demonstrating on his/her computer. Leidner and Jarvenpa (1993) articulated the importance of such electronic classrooms. Another significant development has been in the area of computer-driven or computer- assisted software learning. In this approach, students learn at their own pace at times most convenient to them, they get the chance to test their understanding by periodic computer administered quizzes, and are also advised to revisit some material which they need to get proficient in.

Hermanutz (1991) conducted experiments to compare the effectiveness of computer-based and traditional teacher- centered methods to teaching word processing software. While the two approaches were found to be equally successful, CBT was far less time-consuming for the instructor. Czaza et al. (1986) evaluated the effectiveness

of three training strategies --instructor, manual, and computer --in teaching naive computer users to use word- processing software. This study's participants were 135 women ranging in age from 25 to 70 years. Results showed that CBT was less effective than either instructor-led or manual-based training. In general, subjects who were trained using CBT attempted and completed fewer tasks, took longer to perform tasks, and also made more errors. In another study, Bowman et al. (1995) compared a control group, taught by traditional lectures, with an experimental group using Computer Based Training (CBT). The students in the experimental group performed as well as the students in the control group on homework assignments and hands-on skills tests, and were equally satisfied with their training. Williams and Zahed (1996) investigated the effectiveness of computer-based training (CBT) versus the traditional lecture method on learning and retention. Fifty four chemical processors were the research participants who completed a comprehensive hazardous chemicals safety training program --27 subjects (mean age of 35.1 years) using CBT, while another 27 subjects used the traditional instructor-led sessions (mean age 36 years). They found that (I) each group showed significant learning after training; (2) there were no significant differences in the levels of learning between the two groups; (3) retention after I month was significantly higher in the CBT group; (4) there was no correlation between educational level or computer anxiety and learning; and (5) there was no significant difference between the 2 groups on satisfaction with the training experience. Marks (1992) found that training videos represent an alternative to traditional classroom training or interactive methods for training employees. She reported studies that indicate that people remember concepts if they are linked to images, which can be provided by video training.

To the best of author's knowledge, no researcher has evaluated alternative aooroaches to instructor driven computer software teaching in a classroom setting. This research has initiated investigation into this unexplored area. The next section proposes a descriptive model for evaluating computer software training methods, and articulates alternative software training methods in an instructor-driven classroom setting.

~

2. A DESCRIPTIVE MODEL FOR EVALUATING SOFTWARE TRAINING METHODS

The premise of this model (Exhibit-l) is that a learning mode (or training method) 2 in either individual setting or group setting will be effective in different ways for different kinds of end users (based on their learning styles) and for different types of tasks of learning. Furthermore, the quality of education provided with these modes can be measured in terms of user satisfaction, efficiency of the learning mode (training method), and user performance.

-

Each of these parameters along with relevant literature support is described in detail below.

END-USER **PROFILE Previous studies have utilized cognitive traits as well as descriptive traits of subjects to capture their individual differences (Bostrom et al 1990, page 107). Descriptive traits have included age, educational background, experience with specific software, grade point average, overall computer experience, gender, typing speed, work experience, and years of education. Differences in cognitive traits in many research studies have been labeled as differences in learning styles. (Bostrom et al 1990 make recommendations for software training methods based on four end user learning styles: Converger, Assimilator, Diverger, and Accomodator. The ITA handbook (Web Site-l) on "Learning Styles for Teaching Undergraduates", cites two primary approaches to teaching undergraduates based on differences in learning styles: Atomistic and Global. The Atomistic approach uses rules, gives supporting details, focuses on one topic at a time, approaches topics in a step-by-step manner, and develops specific hypotheses. On the other hand, the Global approach integrates main points into a structural whole, creates an overall picture, integrates descriptive schemes, uses analogies, and develops broad hypotheses and relates subject to personal or real life situations.**

Grupe and Connolly (1995) emphasized the need to customize the learning approach for adults to suit their needs, behavior, and learning styles. They articulated ten characteristics of adult learners that differentiate them from traditional, full time school and college students. These ten characteristics are:
.Adults are not simply grown-up children, they have prior learning experience and have developed important business and personal skills.
.Adults bring considerable knowledge to the learning process.
.Adults are intensely protective of their time. .Adult students and instructor are peers.
.Adults engage in learning activities that are purposeful and are expected to improve specific skills and proficiencies.
.Adults are oriented towards finding solutions for problems.
.Adults want to control and evaluate their own development.
.Adults are active learners.
.Adults seek independence and self direction while learning and implementing new concepts.
.Adults prefer longer uninterrupted involvement in training rather than many short episodes.

~

TASK CHARACTERISTICS Task characteristics can have a significant impact on the dependent variables in the model. In the context of learning software, the characteristics are different for word processing, spreadsheet software., presentation software, and database management software. Furthermore, for a specific software like Excel, characteristics differ according to lesson being elementary or advanced (covering concepts like absolute and relative addressing.)

Problem complexity was shown to be salient in the facility network design decision environment (Guimares T. et al, 1992) and (Ramamurthy K. et al, 1992). Problem size and problem scope can significantly affect human-based performance in location design tasks (Herroelen, w. and Gils Van, 1985) and (Robinson and Swink, 1994). Swink (1995) included different problem sizes and scopes in order to compare the relative effects of task variables against the effects of user and DSS characteristics on decision performance. Goodhue (1998) developed an instrument based on task-technology fit theory in which correspondence between information systems functionality, individual characteristics and task requirements led to positive user evaluations and positive performance impacts (which is similar to the model presented here in the software training method context). Yaverbaum (1988) showed that task factors, organizational factors, and user factors affect end user satisfaction and productivity. Culnan (1993) found a positive relationship between task complexity and information use by professionals in two large commercial organizations i.e., more the task complexity, higher the use of information. Task type has been considered an important factor when analyzing performance of group tasks also. M"Grath (1984) classifies group tasks as creativity or planning tasks, intellective or decision-making tasks, cognitive conflict or mixed-motive tasks, competitive or performance tasks.

In summary, task characteristics such as size, scope, and complexity can have a significant impact on learning software. Kolb (1981) argues that because of the experiential nature of learning, different learning situations are necessarily different experiences. A subject may, therefore, prefer one training method in one situation (task) and a different training method in another situation. This points to the possibility of interaction effects of these two variables.

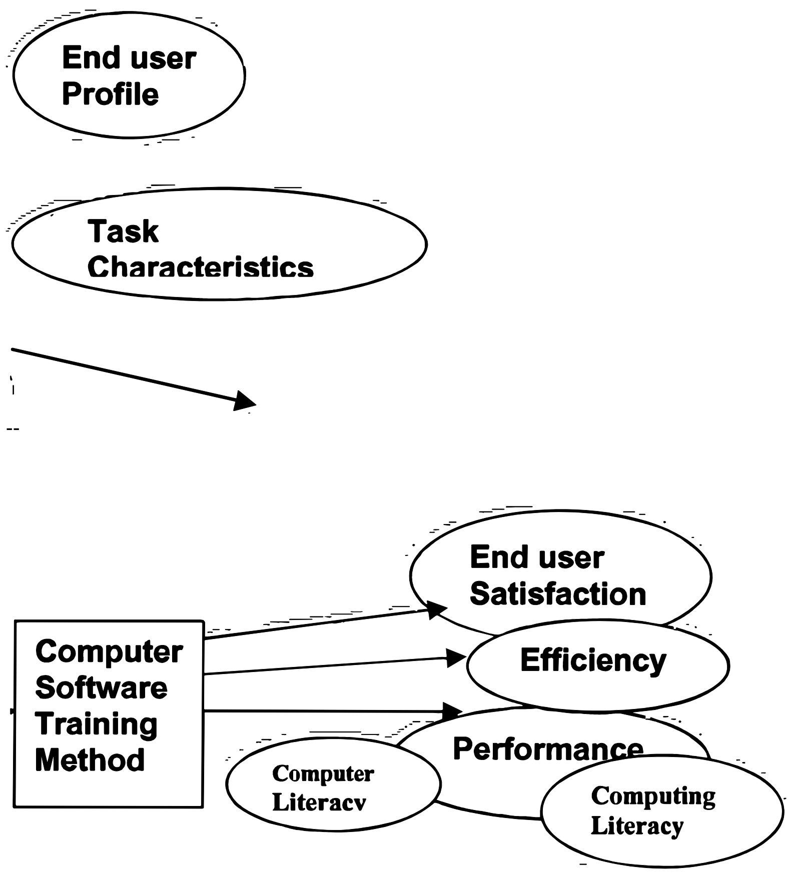

Exhibit-l: Descriptive Model for Evaluating Computer Software Training Methods

COMPUTER SOFTW ARE TRAINING METHODS

The learning modes or training methods can be viewed in the context of learning in either individual or group setting. The individualized learning can occur using an audio, using a video, computer based training sessions, or one-on-one learning from a mentor/teacher. This research focuses on instructor-led learning in group settings. There are two dimensions on which one can classify teaching software in group settings. Dimension **One** is students having or not having computers at the time of instruction for immediate practice. Dimension **Two** is instructor having or not having computer (for immediate demonstration) at the time of instruction. The classification below (Exhibit-2) can be described as follows:

Traditional: Instructor teaching in a traditional mode lecturing and using chalkboard (or easel board) as necessary and students listening and taking notes so that they can practice immediately after teaching.

Delayed: Instructor teaching with computers and students listening and taking notes so that they can practice immediately after teaching.

Asynchronous: Instructor teaching in a traditional mode lecturing and using chalkboard (or easel board) as necessary and students practicing concurrently using computers.

Synchronous: Instructor teaching with computers and students practicing concurrently using computers.

l Instructor Teaching I

l Without l With

l Computers l Computers

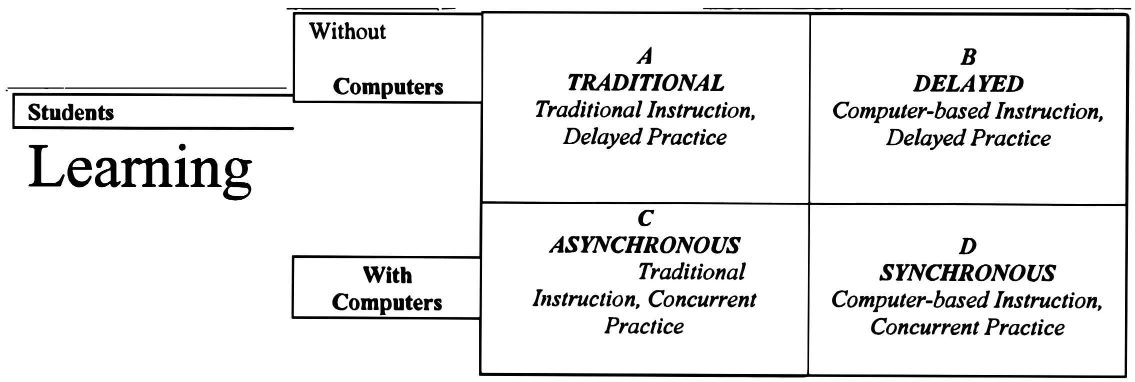

Exhibit 2: A **Framework for Computer Software Training Methods in Group Settings**

It should be recognized that the terms "synchronous" and "asynchronous" have been used in the areas of distance learning, on-line learning, and computer-mediated conferencing. "Synchronous" denotes concurrent communication as in teleconferencing or video- conferencing or on-line chats, whereas "asynchronous" refers to delayed communication as with e-mails, snail- mails, voice-mails. These terms are used in this research in the context of computer use by professor/instructor in synchronous or asynchronous mode.

END-USER SA TISF ACTION The instruments used to measure user satisfaction as articulated in Bailey and Pearson (1983) and Ives et al (1983) measured affect through semantic differential scales (Melone, 1990). Doll and Torkzadeh (1988) proposed an end-user computing satisfaction instrument. This instrument emphasizes the cognitive or belief aspects of attitudes in a short, easy-to-use, application specific instrument using Likert-type scales. The twelve questions in this instrument cover five dimensions --content, accuracy, format, ease of use, and timeliness. It must be borne in mind that these instruments are measuring user or end-user satisfaction with the use of information systems applications. In this research, the focus is on measuring end-user satisfaction with the process of providing software training.

EFFICIENCY MEASURES Efficiency measures the speed of learning a specific lesson pertaining to certain features of a software. Sometimes, the terms --productivity and efficiency are used interchangeably. In an experiment, time provided to complete a lesson can be kept constant or variable.

PERFORMANCE MEASURES Angel (1994) focused on the importance of universal computer literacy in today's information age and attempted to articulate distinction between "computer literacy," "computing literacy," and "computer utilitarian." Computer literacy refers to the knowledge about computer fundamentals. Computing literacy refers to the knowledge and skills needed for using computers. One who has both these competencies is a computer utilitarian. These two connotations could easily apply to computer software literacy also. Palvia and Kim (1997) devoted a paper to the discussion of these ensuing concepts. Some relevant aspects are described below.

Instructors have typically used true or false, multiple choice, and short descriptive type questions to test the knowledge and skills about software. Students have complained that they can perform better if they are tested directly on how to use computer software. Several instructors have instituted software use "performance" tests to gauge students' software use skills. These tests may include: a) creating a professional document using a word processing software like MS-Word or WordPerfect, or b) building a worksheet using spreadsheet software like Lotus or Excel, or c) creating a database and formulating queries

using a database software like Paradox or Access. Perhaps, such tests of proficiency in the use of a software can be called tests of computing (how to use the computer?) literacy skills. Then, what do we call the traditional paper and penciI/pen tests? Should those tests be completely done away with in light of the more popular expeditious computing literacy tests? .

A computing literacy test measures just those skills - ability to tinker with different keyboard buttons, click the two mouse buttons on different icons and menu options, and the ability to persevere and persist by experimenting and exploring to solve problems and achieve the goals using myriad HELP routines and options. But whether one has grasped the fundamentals of software along with its important nuances is a totally different matter. That grasp of fundamentals is in the domain of knowledge as opposed to skills. Knowledge gained can be effectively tested with the traditional paper and pencil mode. This testing is what we can call a knowledge test or computer literacy test. This test can be further broken down into two components: memory recall and comprehension.

Questions in "pencil and paper" tests have traditionally adhered to the dichotomy of multiple choice and essay types. In the vast majority of undergraduate courses, instructors have primarily resorted to multiple choice questions, especially at the freshman and sophomore levels. These questions typically test the students' ability to recall or recognize from memory. The aim of such tests has been to determine whether students can make a distinction between what is right and what is wrong or more precisely between what is not flawed, and what may be totally or partially flawed. Such questions include:

.true/false,
.fill-in-the-blanks,
.match answers with statements, and .multiple choice

Such tests lack the rigor of testing deep knowledge -one that helps in critical thinking. As students become mature in their junior and senior years, instructors have resorted to testing this deep knowledge by asking students to:

.answer complex multiple choice questions .answer short essay type questions;
.analyze a situation (case study), provide diagnostic and prognostic analysis, and suggest solution(s);
.solve mathematical or logical problems by applying learned techniques & algorithms in unique ways.

There is considerable literature support for this dichotomy of computer and computing literacy beyond what Angel(l) has defined. Douglas and Walsh (1992) presented an interesting IT Education matrix making a clear distinction between "education" and "training" as well as between IT personnel and end-users. They suggested that training imparts *computer literacy,* whereas education imparts *information literacy.* Bloom's well known hierarchical taxonomy (Bloom, 1956/1984) of six cognitive learning objectives has a bearing on the classification scheme for software learning. This taxonomy was developed to be used in the context of existing educational units and programs, to be logical and internally consistent, to be consistent with current understanding of psychological phenomena, and to be neutral and free from value judgments. The six objectives of this taxonomy arranged in the sequence oflower-to--higher types of learning are:

a. Knowledge: learners have knowledge of and ability to recall or recognize information.
b. Comprehension: learners understand and can explain the knowledge in their own words.
c. Application: learners are able to use knowledge in real situations.
d. Analysis: learners are able to break down complex concepts or information into simpler, related parts.
e. Synthesis: learners are able to combine elements to form anew , original entity .
f. Evaluation: learners are able to make judgments.

Boom's taxonomy has been a widely accepted logical explanation of learning levels. How do we go from "no knowledge" about a domain to "eureka" feeling about that domain? This journey involves several stages --the first stage involving some kind of cramming or rote memorization, and the last stage (that may happen in weeks, months, or years) may suddenly create an awareness of the understanding of the fundamentals of that topic (so called "eureka" feeling) freeing the person of the need to memorize. Bloom's taxonomy essentially provides us with a six-Iayers or levels of learning between these two extremes of "no knowledge" and "eureka knowledge."

Exhibit-3 uses Bloom's taxonomy for learning levels in traditional disciplines now applied and proposed for learning levels in computer software education. It should be noted that at this time, the comparison is being made only for the first three levels of learning.

Bloom's Taxonomy for Learning Levels in Traditional Disciplines	Taxonomy for Learning Levels in Computer Software Education
Knowledge	Memory Recall (Computer Literacy)
Comprehension	Critical Thinking (Computer Literacy)
Application	Computing Literacy

Exhibit 3: Application of Bloom's Taxonomy Computer Software Learning Levels

3. **RESEARCH HYPOTHESES**

This paper explores if the synchronous learning mode is different in terms of efficiency, performance, and satisfaction compared to the traditional learning mode. The

synchronous learning mode allows both the instructor and students to have computers in front of them for online demonstration and concurrent practice respectively. In contrast, in the traditional learning mode, neither the teacher nor the students have access to computers during the delivery of the lesson.

I. There is no difference in the improvement in Memory Recall and Recognition score for one group of students taught by the synchronous mode and another group of students taught by the traditional mode.
Two *sub hypotheses* are: a. The traditional mode of instruction and learning improves Memory Recall and Recognition score significantly.
b. The synchronous mode of instruction and learning improves Memory Recall and Recognition score significantly.

2. There is no difference in the Critical Thinking (comprehension) improvement for one group of students taught by the synchronous mode and another group of students taught by the traditional mode. Two *sub hypotheses* are:
a. The traditional mode of instruction and learning improves Critical Thinking score significantly.
b. The synchronous mode of instruction and learning improves Critical Thinking score significantly.

3. There is no difference in the Computing Literacy improvement for one group of students taught by the synchronous mode and another group of students taught by the traditional mode.
Two *sub hypotheses* are: a. The traditional mode of instruction and learning improves Computing Literacy score significantly.
b. The synchronous mode of instruction and learning improves Computing Literacy score significantly.

4. There is no difference in the level of satisfaction for one group of students taught by the synchronous mode and another group of students taught by the traditional mode.

4. **RESEARCH METHODOLOGY**

Pre- Treatment Methodology The potential research participants signed a "Subject's Consent Statement." They provided demographic and background data about themselves. Since, this is an exploratory study, no data on learning style was collected. The students also took the Computer Literacy (Knowledge) and Computing Literacy (Skills) tests.

The Knowledge Test included 10 questions that required Memory Recall and Recognition and 5 questions that required demonstration of comprehension of the material. Subjects were allowed 15 minutes to work on this test. The Skills Test involved developing an Excel worksheet that included features like adjusting heights of rows and widths of columns, entering simple formulas and functions, using different font types and font styles, copying cell entries, entering text and numbers. Students were allowed 25 minutes to work on this test.

Treatment Methodology One week later, the "traditional" learning mode treatment was administered to one experimental group, while the "synchronous" learning mode treatment was administered to another experimental group. The students were assigned to the two groups at random. In what follows, first the overall task is described, then the details of the two treatments are provided.

Overall Task: The overall task was to learn how to enter text and numbers, and to enter formulas and functions, including how to copy cell entries. The task continued with learning how to improve the looks of the worksheet by adjusting column widths and row heights, by centering worksheet title over a range of columns, by formatting numbers in different ways, by using different color schemes, and by checking spelling. The task also included the creation of a 3-D bar chart and improving the looks of the chart. Finally, the research participants were required to do some housekeeping like naming the worksheet and bar charts meaningfully and saving the work. More details are provided in the following three paragraphs. The task duration was set at 75 minutes. The task can be classified as relatively simple and straight forward.

For each treatment, each subject received a handout clearly listing the sequence of steps to go through. The handout provided adequate space available for students to take notes. Each student was permitted to ask questions (after raising hand and being recognized by the instructor). The "output printing" steps was skipped to avoid any unnecessary delays and problems during the experiment. All equipment was thoroughly checked before the start of each treatment. To control for effects of classroom and computers layout, all treatments were administered in the same classroom with the same layout. The possible alternatives for the layout of the classroom can be either a) students are seated in rows and columns so that students are facing the instructor (this was our layout) or b) students sitting in U-shape facing the wall with their backs towards the instructor. The students were not allowed to refer to the textbook. The same instructor taught both groups.

Traditional Learning Mode,: For the control group, the instructor went through the entire Excel Project demonstrating every step (these steps were documented in a handout given to the students) using traditional modes of presentation 00 chalkboard and/or easel board and/or overhead projector. Students were encouraged to take notes and ask any questions during the instructor presentation. Once the presentation was over, students immediately practiced the entire lesson themselves. The instructor went around and answered any questions. The total time spent on answering questions and clarifying doubts was recorded.

Synchronous Learning Mode: In this treatment group, the instructor went through the entire Excel Project demonstrating every step on the computer for the students to watch. These steps were also documented in a handout given to the students. The students practiced the steps concurrently with the instructor demonstration. The total time spent on answering questions and clarifying doubts was recorded.

Post- Treatment Methodology
Immediately following the administration of the traditional or synchronous treatment, each research participant took the same two tests that were given at pre-treatment time under the same time constraints.

Each participant was also asked to **fill** out in 5 minutes an instrument to measure the level of satisfaction with the learning mode that he/she experienced. This instrument contained 13 questions pertaining to satisfaction level. Given the exploratory nature of this research, simple semantic differential scales were used. Similar scales were utilized by Bailey and Pearson (1983); and Ives et al (1983) to measure satisfaction level.

s. DATA ANAL YSIS AND DISCUSSION OF RESULTS

It should be noted that the data has been analyzed for only those subjects (II for traditional mode and 15 for synchronous mode) who were present for each of the three components of this research: pre-treatment, treatment, and post-treatment. The fallout in showing up for pre-treatment, treatment, and post-treatment times was very small and random.

End-User Profile Exhibit-4 summarizes demographic profiles of research participants for the two groups --traditional and synchronous learning modes. The profiles resemble in some respects while differ in other respects. Profiles according to age, gender, cumulative GPA, prior full time equivalent experience, prior typing proficiency level, prior word processing and spreadsheet software proficiency, and prior computer use frequency are similar. However, the profiles according to major, college standing, and prior database software proficiency do differ across the two modes. Given the exploratory nature of this research, emphasis was only on capturing demographic traits that were considered important in past studies. Given the context of this research, typing proficiency, prior spreadsheet software proficiency, and prior computer use frequency were identified as the primary traits differentiating participants in the two groups. Since user profiles for the two experimental groups are similar on these characteristics, no further analysis based on demographic traits is necessary.

More than ninety percent of these students were working 25-40 hours in jobs in companies of several sizes and were in diverse industries. Furthermore, on an average, they had more than 4 years of full time equivalent experience, 2.9 to 3.4 years of experience using word processing software, 2 to 2.3 years of experience using spreadsheet software, and I to 1.9 years of experience using database software. Most prominently, their prior computer use frequency was high - -an average between 3.4 and 3.8 (on a scale of I to 5). These characteristics of the research participants confirm labeling them as end users and also indicate high external validity of ensuing results.

Hypothesis-l and its two Sub Hypotheses

There is no difference in the Memory Recall and Recognition improvement for one group of students taught by the synchronous mode and another group of students taught by the traditional mode.

Characteristic	Characteristic Value	Traditional Mode	Synchronous Mode

Major

Management 5 **Marketing** 0 **Finance** 4 **Accounting** 1 **Others** 1

46% 0% 36% 9% 9%

4 3 7 1 O

27% 20% 47% 6% 0%

Gender	Male	7	64%	8	53%
	Female	4	36%	7	47%

Age

Average 21 Std. Dev I

.1

2.1.6 1.0

College Standing	Sophomore	4	36%	1	6.7%
	Junior	6	55%	9	60.0%
	Senior	1	9%	5	33.3%

Cumulative Grade Point Average	Average	3.1	3.0
	Std. Dev.	0.4	0.4
Prior Full Time Equivalent Experience	Average	3.8	3.6
	Std. Dev	1.5	2.2
Prior Word Processing Software Proficiency Level	Average	3.5	2.9
	Std. Dev	1.2	1.1
Prior Spreadsheet Software Proficiency level	Average	2.5	2.0
	Std. Dev	1.1	1.4
Prior Database Software Proficiency Level	Average	1.6	1.0
	Std. Dev	1.5	1.1
Prior Typing Proficiency Level	Average	2.6	2.3
	Std. Dev	0.9	0.7

Prior Computer Use Frequency

Average 3.7 Std. Dev 0.5

3.4 0.7

Exhibit-3: Demographic Profile of Research Participants

Two *sub hypotheses* are:

a. The traditional mode of instruction and learning improves Memory Recall and Recognition score significantly.
The synchronous mode of instruction and learning improves and Recognition and Recognition score significantly.

Intra-Group Testing;, Exhibit-4 below provides a summary of the relevant data for the two experiments. Using t-test (one-sided) for improvement in Memory Recall and Recognition scores (paired differences for observations

from two related populations) with the traditional mode, we cannot reject the hypothesis that there is no improvement in scores even at 0.10 level of significance (degrees of freedom is **10** and p-value is approximately 0.42).
However, the same hypothesis can be rejected even at 0.02 level of significance for the synchronous mode (degrees of freedom is **14** and p-value is approximately .013). So, it is satisfying to note that the synchronous mode contributes to learning in the area of memory recall, but it is discomforting to note that the traditional mode does not.

r

Inter-Group Testing;, Are the improvements in the scores with the two modes significantly different? Using two- sided t-test, even at 0.10 level of significance, we cannot reject the hypothesis that the mean improvements in scores from the two modes are equal (degrees of freedom is 24 and p-value is around 0.40).

Analysis.;. These results are not surprising. First, the synchronous training method resulted in statistically significant increase in the "memory recall" learning for the end users. Second, the traditional learning mode did not result in statistically significant increase in the memory recall. Third, the improvements in "memory recall" scores from the two training methods (or learning modes) are not significantly different.

CHARACTERISTIC	TRADITIONAL MODE	SYNCHRONOUS MODE
Sample Size	11	15
Pre-Treatment Mean Score	5.7	5.4
Pre-Treatment Range of Scores	3-9	2-8
Pre-Treatment Standard Deviation of Scores	1.9	1.5
Post-Treatment Mean Score	6.3	6.6
Post-Treatment Range of Scores	4.5-8	5-9
Post-Treatment Standard Deviation of Scores	1.2	1.1
(Post Treatment - Pre Treatment) Mean Score	0.6	1.2
(Post Treatment - Pre Treatment) Standard Deviation of Scores	1.9	1.6

Exhibit-4: Pre- Treatment and Post-Treatment Data for Memory'Recall and Recognition Test

How do we explain these results? In the traditional mode, both the teacher and the students are exposed to a somewhat "passive" method to teach and learn computer software. Given this context, it would be reasonable to assume that the students' "thinking" faculties were relatively inactive. This lack of activity even worked in a negative manner for 4 out of II students whose Memory Recall and Recognition scores actually went down after the treatment, The synchronous mode in comparison can be termed "active" mode from the point of view of both the teacher and the students, Surprisingly, even in the synchronous mode, the Memory Recall and Recognition scores went down for 2 out of 15 students. As indicated above, based on the t-test, synchronous mode was not significantly better than the traditional mode in affecting the improvement in Memory Recall and Recognition scores.

Hypothesis-2 and its two Sub Hypotheses

There is no difference in the Critical Thinking (comprehension) improvement for one group of students taught by the synchronous mode and another group of students taught by the traditional mode. Two *sub hypotheses* are:

a. The traditional mode of instruction and learning improves Critical Thinking score significantly.

b. The synchronous mode of instruction and learning improves Critical Thinking score significantly.

Intra-Group Testing: Exhibit-5 below provides a summary of the relevant data for the two experiments. Using t-test (one-sided) for improvement in comprehension scores (paired differences for observations from two related populations) with the traditional mode, we cannot reject the hypothesis that there is no improvement in scores at 0.05 level of significance (degrees of freedom is 10 and p-value is around 0..15). The same hypothesis, however, can be rejected at 0.01 level of significance for the synchronous mode of instruction and learning (degrees of freedom is 14 and p-value is less than 0.01).

Inter-Group Testing: Are there differences in the improvement in scores with the two modes? Using two- sided t-test, even at 0.10 level of significance, we cannot reject the hypothesis that the mean improvements in scores from the two modes are equal (degrees of freedom is 25 an p-value is 0.35).

Analysis: It should be noted that "critical thinking" is being used synonymously with "comprehension" in Bloom's terminology. These results are not surprising. First, the synchronous training method resulted in statistically significant increase in the "critical thinking" learning for the end users. Second, the traditional learning mode did not result in statistically significant increase in the critical thinking score. Third, the improvements in "critical thinking" scores from the two training methods (or learning modes) are not significantly different. How do we explain these results? In the traditional mode, both the teacher and the students are exposed to a somewhat "passive" method to teach and learn computer software. Given this context, it would be reasonable to assume that the students' "thinking" faculties were relatively inactive. This lack of activity even worked in a negative manner for 2 out of II students whose critical thinking scores actually went down after the treatment. The synchronous mode in comparison can be termed "active" mode from the point of view of both the teacher and the students. Surprisingly, even in the synchronous mode, the critical thinking scores went down for 3 out of 15 students. As indicated above, based on the t-test, synchronous mode was not significantly better than the traditional mode in impacting the improvement in critical thinking scores.

CHARACTERISTIC	TRADITIONAL MODE	SYNCHRONOUS MODE
Sample Size	11	15
Pre-Treatment Mean Score	4.0	2.0
Pre-Treatment Range of Scores	0-9	0-7
Pre-Treatment Standard Deviation of Scores	2.9	2.5
Post-Treatment Mean Score	5.6	3.9
Post-Treatment Range of Scores	1-9	0-10
Post-Treatment Standard Deviation of Scores	3.2	3.7
(Post Treatment - Pre Treatment) Mean Score	1.6	1.9
(Post Treatment - Pre Treatment Standard) Deviation of Scores	3.5	3.2

Exhibit-5: Pre-Treatment and Post-Treatment Data for

Hypothesis-3 and its two Sub Hypotheses: There is no difference in the Computing Literacy improvement for one group of students taught by the synchronous mode and another group of students taught by the traditional mode.

Two *sub hypotheses* to be tested are: a. The traditional mode of instruction and learning does improve Computing Literacy significantly.

b. The synchronous mode of instruction and learning does improve Computing Literacy significantly.

Intra-Group Testing: Exhibit-6 below provides a summary of the relevant data for the two experiments. Using t-test (one-sided) for improvement in computing literacy scores (paired differences for observations from two related populations) with the traditional mode, we can reject the hypothesis that there is no improvement in scores at 0.01 level of significance (degrees of freedom is 10 and p-value is much less than 0.01). The same hypothesis can be rejected at 0.01 level of significance for the synchronous mode of instruction and learning also (degrees of freedom is 14 and p-value is much less than 0.01). So, it is clearly satisfying to note that both the traditional and synchronous

modes contribute to learning in the area of excel computing literacy.

Inter-Group Testing: Are there differences in improvement in the scores with the two modes? Even at 0.10 level of significance (using two-sided t-test), we cannot reject the hypothesis that the mean improvements in scores from the two modes are equal (degrees of freedom is 24 and p-value is slightly less than 1.00).

CHARACTERISTIC	TRADITIONAL MODE	SYNCHRONOUS MODE
Sample Size	11	15
Pre-Treatment Mean Score	54	50.3
Pre-Treatment Range of Scores	2-80	6-99
Pre-Treatment Standard Deviation of Scores	23.5	31.9
Post-Treatment Mean Score	88	84.4
Post-Treatment Range of Scores	48-100	34-100
Post-Treatment Standard Deviation of Scores	15.1	18.8
(Post Treatment - Pre Treatment) Mean Score	34.0	34.1
(Post Treatment - Pre Treatment Standard) Deviation of Scores	25.4	30.8

Exhibit-6: Pre-Treatment and Post-Treatment Data for Excel Computing Literacy Online Test

Excel Literacy Critical Thinking Test Analvsis: These results appear surprising. Both training methods resulted in statistically significant increase in the "computing literacy" learning for the end users. These results need to be explained for the "traditional" mode especially in light of the fact that this mode did not contribute to statistically significant improvement in the areas of Memory Recall and Recognition and critical thinking scores. What is the difference? It must be recalled from the treatment methodologies section that even in the "traditional mode", the students get to practice the lesson learned with guidance from instructor (when questions are asked by the students and answered by the instructor). So, even in the traditional mode for learning the computing skills, the students are learning in at least a "semi-active" mode. Furthermore, the improvements in "computing literacy" scores from the two training methods (or learning modes) are not significantly different. These results are not surprising. In the synchronous mode, the students were able to be active learners, i.e., they could immediately test their understanding of the subject matter on their PCs. On the other hand, in the traditional mode, the students were learoing technically in a passive mode but in reality in a semi-active mode (the students got to practice the lesson learned with the instructor acting as a facilitator). The question is: why did the students from the synchronous mode of learoing did not perform better on the computing literacy test? The answer may partly lie in the fact that in the synchronous mode, student's attention is distracted from what the instructor is saying. In this mode, the students might really be tinkering with the computers, but are not really thinking. In the traditional mode, the students get a chance to focus and think on the material being covered without being distracted by tinkering with the computers. So, the pros and cons of the two modes probably nullify the net effect on learoing.

Hypothesis-4
There is no difference in the level of satisfaction for one group of students taught by the synchronous mode and another group of students taught by the traditional mode.

Exhibit-S below provides a summary of the relevant data for the two experiments to statistically test these hypotheses. At an alpha level of 0.01 (two-sided test followed by one-sided test), we can conclude that synchronous mode in comparison to the traditional mode is more satisfying in terms of learning for the students (degrees of freedom is 24 and p-value is much less than 0.01). Whether the synchronous mode contributes more in improving in computer or computing literacy is another matter (please, read discussion of hypotheses I, 2, and 3).

CHARACTERISTIC

Sa . Me Ran

Stan ar eVlation <u>of Ratin~s</u>

~RADITIONAL MODE 11 3.4 1.7-4.4 0.8

SYNCHRONOUS MODE

~15 5.3 .3.7-6.5

0.8

Exhibit- 7: Data for Excel Learning Satisfaction Level

2.

6. **CONCLUSIONS**

Each training method did contribute to learning in the area of computing skills. The reason could be that in both modes, the students did get to practice the lesson with the instructor acting as a facilitator. In the traditional mode, the students practiced after the instruction was complete, whereas in the case of synchronous mode, the students practiced while receiving instruction.
All else being equal, does the synchronous mode contribute to better learning? The answer, based on our exploratory research is NO for memory recall and recognition, NO for critical thinking, and NO for computing literacy. Furthermore, the traditional mode did not even contribute to statistically significant improvement in the area of "memory recall" and

3

4

2.

"critical thinking." What does that mean? When neither the instructor nor the students are learning in an active mode with respect to access to a computers, it hampers the learning in the areas of Memory Recall and Recognition and critical thinking. However, to get more definitive answers, there is a need to repeat these experiments with larger sample sizes.
With the above analysis, it is clear that conventional wisdom about the synchronous mode being superior to the traditional mode is true only in one respect --level of satisfaction derived by the learners. As expected, the synchronous mode was evaluated as more satisfactory in terms of the process of learning than the traditional mode. There is a clear behavioral rationale for this finding --when people learn something new, especially with respect to computer software, they want to try it out immediately rather than deferring it to a later time. As reported earlier, Williams and Zahed (1996) found no significant difference on satisfaction with the training experience between the two groups --one learning from CBT method and other one learning from instructor-led method. One must understand the difference in the two groups of Williams and Zahed and the two groups in this research --in the former one instructor was absent during CBT and computer was non-available during instructor led instruction whereas in the latter case, both the instructor and computer were present in both synchronous and traditional learning modes but the timing of computer availability was different.
Though, no data was collected, the author felt somewhat at a disadvantage while teaching in the traditional mode since he was not able to provide immediate demonstration of the concepts and features being taught.

7. IMPLICATIONS FOR RESEARCHERS, EDUCATORS AND PRACTITIONERS

The experiments in this research collected data immediately after administering the two modes of instruction and learning. But substantial long term learning occurs as a result of practice doing home work assignments, in class assignments, quizzes, and examinations. This long term leaming data was hard to measure since it would be difficult to control several confounding variables that might contribute to learning 00 discussions with friends, relatives, professors, co-workers, supervisors, and so on. William and Zahed (1996) collected data one month after the learning experience.

As the model suggests, task complexity is an important determinant of what mode is appropriate for learning. It must be borne in mind that, we chose to do our research with the second lesson of Excel software. Do modes have differing impact based on the co~plexity of features being taught. ? For example, in this lesson, we did not teach relatively complex concepts of absolute addresses or the logical IF

3.

4.

6.

function. In order to draw any long term inferences, there is a need to replicate such experiments with varying complexity of spreadsheet software lessons and also across different domains --word processing software, graphics software, database software and so on.
The prevalent myth about synchronous mode of instruction and learning being superior has been put to some doubt by this research. There is no urgent need for educational institutions and corporate training centers to provide classrooms with online computer demonstration by the instructor. A Professor can just walk into an existing class room, teach software using conventional means, and then facilitate the practice of the lesson in a computer lab.
The research participants conveyed their superior satisfaction with the synchronous mode in comparison with the traditional mode. However, this satisfaction appears to be present for the wrong reasons. Ei.m, some bias in favor of the synchronous mode is likely to be present, since they used the synchronous mode prior to the experiment. ~ tinkering with the computer software in an active mode rather than merely listening to the different features (of the software) and steps to accomplish the task at hand by the instructor might provide instant satisfaction (gratification) to the students. Thiffi, there is some anecdotal evidence that with synchronous mode, the students' attention to learning the concepts is seriously undermined. They have been found to be paying little attention to what the instructor is covering, while being totally engrossed in either surfing the net or e- mailing, or playing the solitaire game.
The instructor might have been satisfied or dissatisfied with the "traditional" or the "synchronous" mode depending on different criteria of satisfaction. Data was !!Q! collected in this research regarding instructor's satisfaction. In future, an instrument for measuring instructor satisfaction should be developed to provide insight into this area. One can argue that instructor satisfaction may be ultimately reflected in students' satisfaction.
Since the pre-treatment scores in regard to memory recall and recognition, critical thinking, and computing literacy for both learning modes are about the same, our approach of statistical analysis can be termed reliable. However, if the pre-treatment scores for the two experimental groups were different, then statistical analysis approach would have to be different to account for the S-shaped learning curve. Stated simply, it is harder to improve one's score from 60 to 90 than from 30 to 60, even though the absolute increase in score is the same in both cases. In such cases, regression approach which includes pre- treatment score as an independent variable would be preferred. Also, it is quite possible that traditional approach might be more effective for subjects with average pre-treatment scores of 30 whereas synchronous approach might be better for subjects

7.

8.

with average pre-treatment scores of 60. This ties in with the factor of end-user learning style in our model. As suggested earlier, there is a need to repeat these experiments with larger sample sizes for each treatment. It must be mentioned that our sample sizes were not too small, given the fact that the data was derived from experiments and not empirical studies; and that we had controlled for variability due to instructor difference, task difference and classroom layout difference. This is a pilot study and if replicated with a larger, better matched samples, could provide solid evidence into efficacy of software training methods. Furthermore, to draw any long term theoretical implications, there is a need to replicate such experiments across different domains --word processing software, graphics software, database software etc. 00 because of the differences in the task characteristics. Also, further work is needed to extend Bloom's six learoing levels to similar six levels for learning software.
Another alternative to training that is fast unfolding is the web-based training. Julia King (1997) reports that corporate education programs are fast replacing live instructors with internet-based training programs -- Lucent Technologies, MCI communications, and Boeing are examples. Mark Name and Bill Catchings (1997) report increase in efficiency and efficacy while reducing costs with web-based training. They go on to describe features of interactivity like alive whiteboard provided by Centra Software's Symposium, Placeware's Auditorium that allows large classes to question both the teacher and other students in both text and audio format.

8. REFERENCES

Angel, Faye N., Dysfunctional versus Utilitarian Computer Use *SAM Advanced Management Journal*, 1994, 59(4), 4-9.

Bailey, J.E. and Pearson, S.W., "Development of a Tool for Measuring and Analyzing Computer User Satisfaction," *Management Science*, Vol. 29, No.5, May 1~83, pp. 530-545.

Bloom Benjamin S.. *Taxonomy of Educational Objectives (Bookl: Cognitive Domain.* 1956 and revised in 1984. ISBN 0- 582-28010-9. Longman. New York.

Bostrom Robert P., Olfman Lome, Sein Maung K., "The Importance of Learning Style in End-User Training," MIS Quarterly, Vol. 14, No.1, March 1990.

Bowman, Brent J., Grope Fritz H., Simkin Mark G., "Teaching end-user applications with computer-based training: theory and an empirical investigation," Journal of End User Computing, Vol. 7, NO.2, Apri11995, pp. 12-18.

Burn, J; Saxena K.B.C.; Ma, Lous; and Cheng, Hin Keung, "Critical Issues of IS Management in Hong Kong: A Cultural Comparison, " Journal of Global Infonnation Management, 1/4, Fa111993, pp. 28-37.

Coffee, Peter, "Courseware authoring tools are no substitute for teachers," PC Week, Vol. 9, No.26, june 29,1992, p. 108.

Culnan, M.j., "Environmental Scanning: The Effects of Task Complexity and Source Accessibility on Information Gathering Behavior," *Decision Sciences,* Apri11983, Vol. 14, No.2.

Czaza, S.j., Hammond K., Blascovich j.j., and Swede H., "Learning to Use word-processing system as a function of training strategy," Behavior and Information Technology, Vol. 5, No.3, july-Sept. 1986, pp. 203-16.

Davis Sid A. and Bostrom Robert p ., "Training End Users: An Experimental Investigation of the Roles of the Computer Interface and Training Methods," MISQ, 17/1, March 1993.

Doll, W.J. and Torkzadeh, G., "The Measurement of End-User Computing Satisfaction," *MIS Quarterly,* Vol. 12, No.2, June 1988, pp. 259-274.

Douglas David P. and Walsh Lori, "Developing an **IT** Education Plan," *IS Analyzer,* Vol. 30, No.2, Sept. 1992.

Goodhue Dale L., "Development and Measurement Validity of a Task-Technology Fit Instrument for User Evaluations of Information Systems," *Decision Sciences,* Vol. 29, No.1, Winter 1998, pp. 105-138.

Grope Fritz H. and ConnoIly Frank W., "Grownups are different: computer training for adult learners," Journal of Systems Management, Vol. 46, No.1, Jan-Feb, 1995, pp. 58-64.

Guimaraes, T., Igbaria M., and Lu M., "The Detenninants ofDSS Success: An Integrated Model," *Decision Sciences,* 1992, Vol. 23, No.2, pp. 409-430.

Hermanutz, M., "Computer-based and teacher-centered training of 'PC-beginners' at college: A Comparative Study," Wirtschaftsinformatik, Vol. 33, No.2, Apri11991, pp. 147-52.

Herroelen, W., & Van Gils, A., "On the Use of Flow Dominance in Complexity Measures for Facility Layout Problems," *International Journal of Production Research,* 1985, Vol. 23, No.1, pp. 97- 108.

Ives, B., Olson, M., and Baroudi, *I.* "The Measurement of User Information Satisfaction," *Communications of the ACM,* Vol. 26, No. 10, October 1983, pp. 785.793.

Johnson Steve and Fancher Lou (illustrators), "1997 --Industry Report, Training Budgets, What Employers Teach, Workplace Trends, and Training Technology," Training Magazine, October 1997, pp. 33-75.

Kim Yongbeom and Kim Youngjin, "Critical IS Issues in the Network Era," *Information Resources Management Journal.* Vol. 12, No.4, Oct-Dec 1999, pp. 14-23.

King, Julia, "Teaching over the Net," Computerworld, Vol. 31, No. 20, May 19, 1997, page 59.

Kolb, D.A., "Individual Learning Styles and the Learning Process," Working Paper 535-71, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA 1971.

Kolb, D.A., "Experiential Learning," in *Theories of Group Processes,* G.L. Cooper (editor), John Wiley and Sons, Inc., New York, NY ,1981.

Leidner D.E. and Jarvenpa S.L., "The Information Age Confronts Education: Case Studies on Electronic Classrooms, "Information Systems Research, March 1993, pp. 24-54.

Marks, Kristin, "Beyond Talking Heads (Training Videos)," LAN magazine, Vol.7, No. 11,Nov.1992,pp.113-118.

McGrath Joseph E., " A Typology of Tasks (Chapter 5)," in *Groups: Interaction and Performance,* Prentice Hall, 1984.

Melone, N.P., "A Theoretical Assessment of the User-Satisfaction Construct in Information systems Research," *Management Science,* Vol. 36, No.1, January 1990, pp. 76-91.

Name, Mark and Catchings, Bill, "Use the Web to Reduce Training Costs," PC Week, Vol. 14, No.15, Apri114, 1997, page 87.

Nelson, Ryan R., "Educational Needs as Perceived by IS and End- User Personnel: A Survey of Knowledge and Skills Requirements," MIS Quarterly, Vol. IS, No.4, December 1991.

Niedentlan F., Brancheau *l.C.,* and Wetherbe *l.C.,* "Infontlation Systems Management Issues for the 1990s," **MIS** Quarterly, 15/4, December 1991, pp. 475-495.

Palvia Prashant and Palvia Shailendra, "MIS Issues in India and a Comparison with the United States," International Information Systems, 1/2, Apri11992, pp. 100-110.

Palvia Prashant and Wang Pien, "An Expanded Global Information Technology Issue Model; The Addition of Newly Industrialized Countries," Journal of Information Technology Management, 7/2, 1995, pp. 29-39.

Palvia Shailendra and Kim Youngjin, "Measurement Approaches for Computer Software Literacy: A Conceptual Classification," *Proceedings of national Decision Science Institute Conference,* San Diego, CA, November 1997.

Ramamurthy, K., King W.R., & Premkumar G., "User Characteristics --DSS Effectiveness Linkage: An Empirical Assessment," *International Journalof Man-Machine Studies,* 1992, Vol. 36, pp. 469-505.

Rao, K.V.; Huff, F.P.; and Davis G.B., "Critical Issues in the Management of Information Systems: A Comparison of Singapore and the USA," Information Technology, 1/3, 1987, pp. 11-19.

Robinson, E.P. Jr. & Swink M., "Reason based Solutions and Complexity of Distributed Network Design Problems," *European Journal of Operational Research.* 1994, Vol. 76, pp. 393-409.

Stecklow Steve, "1-2-3 Training Options," Lotus, July 1992

Swink M., "The Influence of User Characteristics on Performance in a Logistics DSS Application," *Decision Sciences,* 1995, Vol. 26, No.4, pp. 503-529.

Web Site-l : **wwwucsb.edu/ICrr A/IT** A/teach.chart.html.

Williams, T. Craig and Zahed Hyder, "Computer Based Training versus Traditional Lecture: Effect on Learning and Retention," Journal of Business and Psychology, Vol. II, No.2, Winter 1996, pp.297-310.

Yaverbaum Gayle *I.*, "Critical Factors in the User Environment: An Experimental Study of Users, Organizations, and Tasks," MIS Quarterly, Vol. 12, No.1, March 1988, pp. 75-90.

AUTHOR BIOGRAPHY

Shailendra C. Palvia is Professor and Director of Management Information Systems at the Long Island University, New York (USA). He received his Ph.D. from the University of Minnesota. His research publications are in the areas of management of the systems development process, mode of use in problem solving, implementation issues for MIS/DSS, global information technology, software training methods, and global electronic commerce. His work has been published or forthcoming in refereed journals such as Communications of the ACM, MIS Quarterly, Information & Management, Journal of Global Information Management, International Information Systems. He is the co-editor of two books on Global IT , one published in 1992 and the other published in 1996. Dr. Palvia is currently Editor-in-chief of the Journal of Information Technology Cases and Applications (nTCA) and an Associate Editor of the Journal of Global Information Technology Management (JGITM). He has been an invited speaker to Boston (USA), Stuttgart (Germany), Singapore, Bombay (India), and Bangalore (India), Anand (India).

Information Systems & Computing
Academic Professionals

Serving Information Systems Educators

STATEMENT OF PEER REVIEW INTEGRITY

All papers published in the Journal of Information Systems Education have undergone rigorous peer review. This includes an initial editor screening and double-blind refereeing by three or more expert referees.

ISSN 1055-3096