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ABSTRACT

A study was undertaken to explore whether students using an advance organizer-metacognitive learning strategy would be less anxious, more self-directing, more efficient, and more self-confident when learning unknown computer applications software than students using traditional computer software learning strategies. The first experiment was conducted with 164 students (average age 22) from a freshman orientation course which included a 1-hour word-processing applications software instructional component. The second experiment was conducted with 76 students (average age 33) from an introduction to computer course which included introductory presentations on three software applications types. Scores were gathered on each of four variables from two experiments which differed in the amount of time dedicated to exposure to the software strategies. Results indicate that the advance organizer-metacognitive learning strategy is somewhat more effective in improving student performance than traditional learning strategies, but the use of the learning strategy is only marginally more effective in improving students' self-concept of their capabilities to learn software than traditional learning strategies. Appendices include the teacher presentation outline; student notes for WordPerfect 5.1 (DOS); self-reporting 1-minute typing measure; the word-processing exercises and student computer exercise forms from both experiments; and the postcourse survey. (Contains 154 references.) (Author/AEF)

EFFECTIVENESS OF A STANDARD COMPUTER INTERFACE PARADIGM ON COMPUTER ANXIETY, SELF-DIRECTION, EFFICIENCY, AND SELF-CONFIDENCE

By

HUGH C. WARD, JR.

A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF EDUCATION

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I dedicate this work to my wife, children, and the many family members and friends whose continued support made this effort possible.

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EFFECTIVENESS OF A STANDARD COMPUTER INTERFACE PARADIGM ON COMPUTER ANXIETY, SELF-DIRECTION, EFFICIENCY, AND SELF-CONFIDENCE

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Chairman: Elroy J Bolduc
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A study was undertaken to explore whether students using an advance organizer-metacognitive learning strategy would be less anxious, more self-directing, more efficient, and more self-confident when learning unknown computer applications software than students using traditional computer software learning strategies. To examine these effects, scores were gathered on each of four variables from two experiments. The two experiments differed in the amount of time dedicated to exposure to the software strategies.

The first experiment was conducted with students (average age 22) from a freshman orientation course which included a 1-hour word-processing applications software instruction component. One hundred sixty-four students participated in the entire experiment.

The second experiment was conducted with students (average age 33) from an introduction to computers course which included introductory presentations on the following three software applications types: word-processing, spreadsheet, and data base management, totaling 15 hours of instruction. Seventy-six students participated in the entire experiment.

Results from the two experiments using measures of anxiety, self-direction, efficiency, and self-confidence were mixed. The first experiment found the advance organizer-metacognitive learning strategy to be equally as effective as the traditional learning strategy in reducing anxiety, slightly more effective in increasing self-directing capabilities, slightly less effective in increasing efficiency, and slightly more effective in improving self-confidence. The second experiment found the advance organizer-metacognitive learning strategy to be equally as effective as the traditional learning strategy in reducing anxiety, more effective in increasing self-directing capabilities, more effective in increasing efficiency, and equally as effective in improving self-confidence.

The results from these two experiments indicate the advance organizer-metacognitive learning strategy is somewhat more effective in improving the performance of the students in learning new applications software than traditional learning strategies, but the use of the learning strategy is only marginally more effective in improving the students' self-concept of their capabilities to learn software than traditional learning strategies.

Future research studies should include what other types of educational settings, categories of software, and populations are affected by an advance organizer-metacognitive approach to learning computer software.

CHAPTER 1
INTRODUCTION

To become computer literate, individuals to a large extent depend upon systematic, effective, and timely presentations of computer concepts, definitions, and processes. A review of community colleges' term schedules show these presentations offered in organized settings such as courses, workshops, and training sessions. The definition of computer literacy has changed somewhat over the past 12 years. A review of computer literacy articles found a change in emphasis gradually occurring. For example, Anderson (1982) suggested that as part of a computer literacy curriculum, a focus should be placed on the use of computers as an object of instruction. Aron (1982) stated,

> To function in society, the minimally literate person has to be able to respond to a computer in the manner it has propagandized to expect. This implies an ability to follow instructions in a step-by-step sequence. (p. 9)

Butler (1985), noting the change in emphasis coming in computer literacy curricula, said, "[T]here is much interest in integrating applications programs such as word processing, spread sheet, and data base management programs into the curriculum" (p. 125). Bartkovich (1988) from a study of the computer literacy issue concluded that "computer literacy should stress doing things with the computer, especially software tools" (p. 227). By 1987, the field of computer literacy had evolved to the point where standardized tests for computer literacy were developed (Simonson, 1987). Malpiedi (1989) also noted the changes in the definition of computer literacy. In the area of teacher computer literacy education, Troyer (1988) found, "The heavy programming emphasis prevalent in earlier teacher computer literacy education seems to have given way to a broader focus on a variety of topics" (p. 146). Today, the idea of what is computer literacy has evolved to the point that Overbaugh (1993) developed four different models describing the evolutionary process to become computer literate. From the beginning of use of the term computer literacy in the late 1970s and early 1980s, the set of skills necessary to use common application software packages effectively is certainly accepted by most computer educators to be under the umbrella of the term computer literacy.

Because learning to use software is a very important facet of computer literacy, it seems appropriate that means should be sought that would allow nonstressful, self-directing, timely, and proactive learning of software packages to occur. Bunderson (1987) supported the idea. He called for curriculum materials to be developed which have easy-to-learn conventions which will speed the process of user training. In general, no two software packages use the same basic set of commands on MS-DOS platforms (unlike the MacIntosh platform and, to some extent, the WINDOWS interface program). According to Grice (1989),

> One of the biggest obstacles that people encounter when using computer products is the wide variety of standards, conventions, and practices that are in general use. (p. 36)

Therefore, in order to allow users to utilize their respective software packages effectively and efficiently, the learning strategy employed by learners should be as generic, straightforward, and transferable as possible. Butler (1985) calls for research into software teaching strategies versus teaching the computer as an separate entity. He stated,

> There is growing interest in teaching applications programs such as word processing, spreadsheets and data base management across the whole curriculum, but little is known yet about the difficulties experienced by students and [computer literacy] teachers who use this approach. Research is urgently needed. (p. 489)

Researchers have shown that "excessive levels of anxiety can inhibit learning" (Honeyman & White, 1987, p. 129). Therefore, any successful learning strategy developed to teach software must be developed with a sensitivity towards the effects it may have on the anxiety levels of students who would use it. Without a conscious effort to lower anxiety levels, the results may be limited. Mager (1992) said,

> For people actually to do things they need to do to perform a job successfully, these four conditions must be present: skill, self-efficacy [self-confidence], opportunity to perform and a supportive environment. (p. 32)

In short, the learning strategy should be formed in such a way that it reduces the student's anxiety levels during the software learning process. Sieber, O'Neil, and Tobias (1977) called for anxiety treatments to have two basic effects: (a) improve the proficiency of doing the task and (b) improve the individual's sense of well-being. This reduction of anxiety should manifest itself in the individual in three ways. The individual should be more self-directing in approaching new software, should use less time to learn new software, and should have more self-confidence in attempting new software.

Purpose of the Study

The purpose of this study was to determine the effects of a software learning strategy on the technical performance levels and on the self-concept images of students when they first learn to use unknown application software. Specifically, the study was designed to determine if an advance organizer-metacognitive learning strategy, when used by students to learn the basic operations of an unknown application software, would (a) decrease the student's level of anxiety (computer anxiety), (b) enable students to be more self-directing self-direction), (c) decrease the student's time necessary to master the basic operations of unknown application software efficiency), and (d) increase student's self-confidence).

The Learning Strategy

What follows is a description of the software learning strategy tested in this study. Included in this description is a discussion of the rationale for the learning strategy, and its five structural elements. Finally, there is a brief discussion concerning how a structured learning approach can be a useful to new users of software.

All human interactions, in their simplest terms, can be described as processes defined by the following three words: INPUT, PROCESSING, and OUTPUT. Take, for example, the following discourse between a teacher and an elementary student:

TEACHER: "Sam, what is 7 times 4?"

STUDENT: "28, sir."

This short exchange between the teacher and the student represents a lot more activity on the student's part than just his response.

The student, using ears and eyes as INPUT devices, took in the question. Scanning through the question, the student found the key word "times" and immediately drew upon his past knowledge to PROCESS the question. Following the use of a previously learned algorithm and/or table, he was able to OUTPUT his response to the question with his voice.

Think of the hundreds of interactions we all have each day; each requires input of data, a search in our memory for the appropriate matching process and output of information.

If one looks carefully at a computer, it is obvious that it was constructed to model human interactions. Travers (1982) stated, "The device nearest to the human as an information storage system is the computer" (p. 15). This premise has been supported by psychologists for nearly 30 years. Brown, Bransford, Ferrara, and Campione (1983) stated, "Since the mid-1960s comparisons between human cognition and the computer have motivated psychological models and monopolized theories of human cognition" (p. 79). The following description of human memory in computer terms is a good example of the use of the computer analogy. Carroll (1986) stated,

> According to most models of memory, information is initially received in a sensory buffer, referred to long-term memory for interpretation, and put into short-term memory or working memory where it may be either further processed and transferred to a long-term store. (pp. 102-103)

Rosenbloom and Newell (1988), in a description of the information-processing theory of learning, called it a combination of the behaviorists' and cognitivists' learning theories. The information-processing theory of learning combines the behaviorists' view of the mind as a machine with cognitivists' concepts of structured mental images and analog representations. Current introduction to computer textbooks use the human interaction analogy. For example, Andrews, Thomason, and Fujimoto in their 1986 edition of The Art of Using Computers stated, "As an information processor, you organize data and information dealing with your day-to-day activities" (p. 40). Andrews et al. further suggested, "In truth, the real information processor throughout history has been, and still is, the human mind" (p. 41).

The modern computer's basic design is nothing more than a reflection of this concept. All computers from the 1946 ENIAC to today's microcomputer share this common design. Today, the keyboard serves as the most commonly used input device. The central processing unit (CPU) of the microcomputer is the processor portion of a computer. Finally, the screen or the printer serve as the output device for the results the input moving through the processing section of a computer.

Just as a human uses past experiences to solve a variety of problems, the computer's design allows it to solve diverse problems. Just change the program in the CPU, input new data, and you solve a different problem. It is apparent that software, too, is written to match the I-P-O model of interactions. To utilize the existing I-P-O hardware devices of a computer, software programs are structured to match the particular I-P-O devices of a computer to produce information. For example, what good would a multiplication program be if its results could not be displayed?

The I-P-O model reflects and links human interaction, computer hardware design, and computer software design. This general model leads to a structured approach to understand the basic operations of the vast majority of software programs regardless of the model of the computer or the purpose of the software program, now and in the future.

Through the examination of several hundred software programs over a 10-year period, the author developed a five-question structural approach, drawn from the I-P-O model, for discovering quickly and efficiently the basic operations of new software. This software learning strategy has proven useful for the author in his classroom, but, more importantly, the learning strategy can be taught to students for use long after they have left the classroom.

The five subsuming questions of the learning strategy are as follows:

1. What is the **S**tartup procedure?
2. What is the **I**nput procedure?
3. What is the **S**ave procedure?
4. What is the **R**etrieve procedure?
5. What is the **O**utput procedure?

The learning strategy will hereafter be called "**SISRO**" because of the five descriptive words used in the above questions.

The SISRO learning strategy has two parts. The first part of the SISRO strategy requires the new user of a unknown software package to have or acquire a basic idea of what kind of information will be generated by the type of software package being used. For example, to learn to use a spreadsheet, one must already know that a spreadsheet, at its most basic level, can be described as an electronic general ledger. This conceptual idea of what will be the end product created by the software package serves to focus and guide the learner through the implementation of the SISRO learning strategy. This calling attention to the purpose of the program is supported by Gagne (1977) as one of his nine steps to improve instruction. Additionally, Glaser (1988) seemed to support this idea. He suggested the shift from a novice learner to an expert learner comes about when the student recognizes the underlying principles and patterns in given tasks. He further suggested that experts use problem-solving skills better than novices because they "possess knowledge about the application of what they know" (p. 24).

The second part of the SISRO learning strategy consists of the student discovering or being shown the particular local environment conditions (hardware, software, manuals, etc.) for each of the five basic software operational questions. For example, one of the local environment sources is the instruction or reference manual for the unknown software. Consciously using the SISRO questions with the instructional or reference manual has the effect of imprinting on the manual, a structured approach that can make even the most poorly written and voluminous one a useful reference source.

The old Chinese proverb, "a thousand mile journey begins with its first step," is a good analogy for the first question of the SISRO learning strategy, "What is the Startup procedure?" The first part of the answer to the question is to find out the specific switches, buttons, and other hardware manipulations that must be occur before the specific software is loaded into the memory of the computer. These computer environment procedures are very specific to the particular hardware systems and local networks that may be present. The second part of the answer is to find out the particular operating system and software commands to get to the main data entry point of the software. Once this is accomplished, the user is at the end of the startup procedure.

The second question of the SISRO learning strategy is "What is the Input procedure?" The number of steps necessary to accomplish this depends on the accompanying data entry structure. For example, with word processing once you get to the general entry screen, you just start typing. However, with a database program you would first be required to create the input structure and only then could you enter data points. In either case the entry of data again assumes the user knows what he or she is generally trying to create from the type of software being used.

The third question of the SISRO learning strategy is "What is the Save procedure?" With this question the user is confronted with three basic scenarios that require saving the data. The first scenario is when the user wishes not to lose a significant portion of the data due to an interruption of power. Therefore, a subprocedure is found for continuously saving the data at regular time intervals so that if the power is interrupted, the user only has to reenter a small portion of the data. The second scenario is when the user wishes to save one set of data and then begin work with a completely different set of data. For example, you finish a letter to one person and wish to save it and then type another letter to someone else. Again a subprocedure must be found to save one set of data and seamlessly begin work with another set. The third scenario is when you wish to save your current data and quit entirely the software package. Here again, a subprocedure must be discovered to save and then exit the program.

The fourth question of the SISRO learning strategy is "<u>What is the **R**etrieve procedure?</u>" The ability to recall previous data that are 1 hour or 1 year old permits the computer user to build and update data in a timely and efficient manner. The previous Save procedure evoked by the user will dictate what operating and/or software commands are necessary to retrieve a data file. For example, if the user has the computer physically turned off and wishes to update a database record, the user would first have to do some or all of the startup procedure before invoking whatever commands are necessary to edit a particular database record.

The fifth question of the SISRO learning strategy is "What is the Output procedure?" The institutions of our society from the IRS to the local grocery store still demand printed materials in one form or another. It seems ironic that while your paycheck may be electronically transferred to your checking account, within a few days a printed receipt of the transfer is sent to you to verify the transaction. Therefore, it seems, for the near future, computer-created output of the printed type will continue to dominate this procedure. The software steps necessary for output are usually standard from one location to another with the exception that initially the local printer specifications must be set up inside the software program's output defaults.

See Appendix A for a sample of SISRO teacher presentation materials and Appendix B for a sample of SISRO student notes for WordPerfect 5.1. In one sense, the goal of encouraging the adoption by students of the SISRO learning strategy is an attempt to move them quickly from being a novice in implementing the use of computer application software to being an expert. Carey (1990) believed understanding of a schema relevant to a problem is one of the seminal differences between a novice learner and an expert learner. Experts use schematas to help grasp a problem in ways that a novice cannot (Carey, 1990). Glaser (1988) defined a schema "as a modifiable information structure that represents generic concepts stored in memory" (p. 25). By consciously and methodically following the SISRO learning strategy just described, it is hoped that a user gains a less anxious, more self-confident, more efficient, and more self-directing approach to learning new software. Mager (1992) seems to be supporting this belief when he states, "The most powerful way to give me self-efficacy [self-confidence] regarding my ability to do something well is to teach me to do something well" (p. 34). Further, this SISRO learning strategy approach may lead to a large and diverse section of our population becoming capable of discovering the basic operations of software programs in a nonstressful, independent, efficient, and self-confident manner.

Significance of the Study

An effective application software learning strategy would be of value to adult learners, students, computer science educators, and program administrators. The significance of the application software learning strategy to each of the above-mentioned interests is discussed below.

Adult Learners

Hull (1992) reported, "Eighty percent of the people who will make up America's workforce in the year 2000 are already adults" (p. 18). It is all too apparent that computers are a growing part of today's life and will be more so in the future. Hull further stated, "Today's workplace requires advanced technical skills and the ability to understand complex theories and processes in rapidly changing and emerging technologies" (p. 15). Lifelong learning in our increasingly technologically driven society will require adults to learn new or updated software constantly to be valuable to a competitive business. Geber (1993) stated the conventional wisdom about business competitiveness, "Everybody says smarter workers would make the nation competitive again" (p. 28). The ability to incorporate new software into the fabric of business or manufacturing enterprises quickly and efficiently might make the difference in the success or failure of the enterprise. Carr (1992), speaking about how business evaluates today's training, stated,

> The *results* of training can be measured in terms of effectiveness and conciseness. Training is *effective* when it accomplishes the intended performance improvement. It is *concise* when it lasts no longer, causes no more disruption, and thus is no more expensive (in terms of trainee salaries and lost productivity costs) than necessary. When a secretary can return from training and use the new version of her word-processing software immediately, the training was effective. If the training took her away from her job for a minimum amount of time, it was concise. (p. 61)

Through the use of a standardized and cognitive approach, the SISRO learning strategy should provide adults with the confidence and the skills to independently learn the basic operations of present and future software programs.

Students

Students are increasingly required to become computer literate. Today many teachers assume students know how to use word-processing software and other types of software programs and base the length and complexity of their assignments on that assumption (Selfe, 1992). Further, many students must learn to use school software which may be different from what they may use in home and business settings. Sanders (1986, as cited in Martin 1990), suggested students possessing an aversion to technology are likely to become adults who are most fearful of it and will come to view the computer as a threat rather than a tool. This fearful condition has important occupational consequences. The students' use of an efficient and self-directing software learning strategy will facilitate the timely adoption of new and different software and can only serve to boost their self-esteem.

Computer Science Teachers

Educators charged with presenting new software would find the efficiency of the SISRO learning strategy would allow them to present more complex commands of software packages since the time necessary to teach the basics would be reduced. The generic nature of the SISRO learning strategy would provide a cognitive structure students could use in future computer courses. The reduction of the anxiety level in the classes would help create a positive and supportive environment ideal for learning technical processes. The SISRO learning strategy would provide a simpler approach to teaching s ftware pa kages, thereby allowing computer literacy and applications teachers to cover more software packages or to discuss more features of the same number of software packages.

Program Administrators

Administrators charged with providing and directing computer courses are very concerned with the continued strength and existence of their programs and are looking for ways to improve their programs. McWilliams (1991) said,

> Pressured by dwindling enrollments and budget woes, a small but growing number of schools are looking to business and adopting techniques, strategies-even the language of-quality management. (p. 144)

Peter Kolesar, research director at the Deming Center for Quality Management at Columbia University, is quoted by McWilliams as saying, "Administrators are smart enough to see the implications [of total quality management] for teaching" (p. 145). To that end, with all the changes the SISRO learning strategy would provoke inside teachers' classrooms, entire programs would be affected in some very positive ways.

Any educational program's greatest strength, and ironically its greatest weakness, is the quality of the teacher's instruction in his or her classroom. Hull (1992), speaking generally about effective changes in education, stated,

> In educational reform movements, teachers and principals are the ones who facilitate changes at the foundation, thereby determining the degree of success of an innovative program. (p. 19)

This learning strategy could be shared with new and struggling teachers, thereby reducing the variance in the quality of teachers' presentations.

Computer science courses are highly sequenced in their difficulty level. "Introduction to Computer" courses form the base of a pyramid-like physical description of successively harder and fewer advanced computer courses. Grunder and LeBlanc (1992) reported the national community college overall dropout rate for full-time first semester incoming students is 35%. If use of an effective learning strategy helps reduce the dropout rate in the beginning computer science courses, marginal and nontraditional students may have the necessary time to develop the cognitive structures necessary for such a technical area as computer sciences and may, therefore, take additional courses. Administrators, thus, would be assured that the base of their programs would be sufficiently wide enough to ensure the viability of the entire program.

Another positive change with the adoption of the SISRO learning strategy would be the possibility of increasing the depth and breath of what is covered in a course; in short, restructuring would be possible. Consequently, the existing course sequences could be changed to match the needs of the students. More complex courses could be added while shorter beginning courses or workshops could be introduced. Finally, a successful program using this learning strategy would add prestige and financial rewards to an institution and build its reputation in the community and beyond, based on retention rates of a diverse student population. Amador (1986) said,

> Program success and increased tuition generation can be achieved by providing adult computer literacy programs that respond to the market audiences that want to realize the full potential of their computers. (p. 79)

Design of the Study

As stated earlier, the purpose of this study was to determine the effects of a software learning strategy on the technical performance levels and on the self-concept images of students when they first learn to use unknown application software. Two different types of college courses were selected because they represented time exposure extremes in which an application software learning strategy could be formally presented. The freshman orientation course included only a 1-hour computer word-processing component in its curriculum, while the introduction to computer course included at least 15 hours of application software presentations and practice. Subsequently, in the lecture section of the introduction to computers course, references were often made to the learning strategies necessary to use application software and the learning strategies' importance outside the course. Additionally, from the author's personal experience of teaching introduction to computer courses over the past 11 years in community college settings, how to use software is the most popular part of the curriculum from the student's perspective. In short, time exposure to application software represented a small portion of the freshman orientation course curriculum, while in the introduction to computers course, time exposure to application software represented a large portion of the curriculum.

While the SISRO learning strategy has been previously defined, the major elements of the traditional learning strategy need to be described briefly. The traditional learning strategy for application software consists of two major elements. The first element is the presentation of the software. Software is generally described as a local task event, that is, there is little or no organized reference or linkages provided to previous software programs or the user's possible previous software experience. The second element is the general lack of references to use the learning process as a strategy in and of itself for the future, that is, once the basics of a particular program are known, little or no effort is expended to call the user's attention to common features that may be useful with unknown programs in the future. In short, the traditional learning strategy can be successful in teaching a particular application software; however, it is a distinctly local and ephemeral event.

Course sections were selected for the study by a convenience sampling strategy. Following the course section selections, a conference with instructors was conducted to appraise them of the study's needs. The freshman orientation course sections for Experiment One were divided into three groups, Control, Traditional treatment, and SISRO treatment. While the choice of the Control group sections was based on random selection, both the Traditional and SISRO treatment instructors of their respective groups were chosen based on their possession of previous computer software word-processing experience with using and teaching WordPerfect. They were placed in the treatment groups on a random selection basis.

The Experiment Two course section instructors of the introduction to computers course were placed in their treatment groups on a random selection basis. It was not necessary to use any conscious method to pick the instructors for each group because their computer science teaching experience levels were approximately equal.

In this study, word processing was chosen as the type of application software to use for several reasons. First, use of a microcomputer to do word processing represents the dominant use of computers today. Powers (1991), in survey of community college students selecting future computer courses, found over 85% were interested in Word-processing courses. Spreadsheet and Data Base management courses were second and third choices, respectively. Smith and Furst-Bowe (1993) found in a survey of freshman students that 90% of those with previous computer experience used word processing 90% of the time when they used a microcomputer. Woodrow (1991) in a study of teacher's perceptions of computer needs found teachers overwhelmingly ranked word processing as their top choice. Second, since it was the first applications software presented in the introduction to computers course, the initial experience and anxiety levels among the students would be at their widest. Third, logistical concerns about availability of testing sites, length of time for group testing, and limits on availability of test materials made early testing during the college term a necessity. Fourth, computer word processing closely resembles mechanical typing word processing and, therefore, is familiar to large numbers of students. Waern (1993) suggested this familiarity is useful because "when a new situation consists of a computerized version of a former noncomputerized task, we may assume prior knowledge of the task will be evoked" (p. 325). This fact would increase the potential of a larger number of students volunteering to participate in the testing exercise, since they all would have some familiarity with concept of word processing.

Adults (18 and over) were the subjects of this study. To obtain the widest possible age range in the students, daytime freshman orientation courses, whose students' average age was 22, were chosen for Experiment One. Nighttime introduction to computers courses, whose students' average age was 33, were chosen for Experiment Two.

The self-concept efficacy of the SISRO learning strategy was assessed using measures of anxiety and self-confidence. These measures came from a standard anxiety instrument called the State Trait Anxiety Indicator (STAI), participation in an computer exercise measures, and possession of previous computer skills. Additionally, answers to related questions in a precourse, postcourse self-reporting survey for Experiment Two group members only were used.

The technical effectiveness of the SISRO learning strategy was assessed in all experimental conditions by using measures of the self-direction and efficiency. These measures came from the results of a volunteer computer software exercise and (for Experiment Two group members only) answers to related questions in a precourse, postcourse self-reporting survey.

In summary, Experiment One group members had limited exposure to both learning strategies. In Experiment Two, group members had extensive exposure to both strategies. Measures of computer anxiety, self-direction, efficiency, and self-confidence were used in both experiments to determine the efficacy of the SISRO learning strategy.

Hypotheses

In order to answer the question under investigation, hypotheses were generated for each of the two experiments.

These hypotheses are stated below in the null form and were tested at the .05 level of significance. The hypotheses follow each of the two experiment titles and their defining time exposure statements.

Experiment One: Limited Time Exposure to Software Learning Strategies

Hypothesis I: There is no significant difference in the computer anxiety levels between the two learning strategy groups as measured by the State Trait Anxiety Indicator S scores.

Hypothesis II: There is no significant difference in self-direction ability between the two learning strategy groups as measured by the number of questions asked to complete an application software task.

Hypothesis III: There is no significant difference in the efficiency levels between the two learning strategy groups as measured by the amount of time needed to complete an application software task.

Hypothesis IV: There is no significant difference in the self-confidence levels between the two learning strategy groups as measured by the following three measures:

1. Difference in percentage from each group who attempted the application software task with the previous computer experience.

2. Difference in typing speed from each group who attempted the application software task.

3. Difference in the percentage from each group who attempted the application software task.

Experiment Two: Extensive Time Exposure to Software Learning Strategies

Hypothesis I: There is no significant difference in the computer anxiety levels between the two learning strategy groups as measured by the State Trait Anxiety Indicator S scores.

Hypothesis II: There is no significant difference in the self-direction ability between the two learning strategy groups as measured by the number of questions asked to complete an application software task.

Hypothesis III: There is no significant difference in the efficiency levels between the two learning strategy groups as measured by the amount of time needed to complete an application software task.

Hypothesis IV: There is no significant difference in the self-confidence levels between the two learning strategy groups as measured by the following nine measures:

1. Difference in the likelihood of taking specific computer courses chosen in the future.

2. Difference in the likelihood of learning specific software on their own in the future.

3. Difference in expectation levels of difficulty when taking unspecified future courses.

4. Difference in self-confidence ability levels to learn unspecified future software on their own.

5. Difference in the percentage from each group who attempted the application software task with the previous computer experience.

6. Difference in the typing speed from each group who attempted the application software task.

7. Difference in the percentage from each group who attempted the application software task.

8. Difference in the choice of most useful skill to do application software task.

9. Difference in the choice of least useful skill to do application software task.

Limitations of the Study

The following conditions are the limitations of this study:

1. Time exposure to the software learning strategies to minimum and maximum time extremes set the basic difference between the two experiments.

2. The SISRO Learning Strategy and a Traditional Learning Strategy were the only learning strategies used with the two experiment's group members.

3. Word-processing software was the only type of software used.

4. The subjects of the study were limited to adult students (over 18) in a community college setting taking a

freshman orientation course and an introduction to computers course.

5. Measures of the self-concept efficacy of the SISRO learning strategy were assessed using only measures of anxiety and self-confidence.

6. Measures of the technical effectiveness of the SISRO learning strategy were assessed using only measures of the self-direction and efficiency.

7. Not included in the study were measures for the variables gender, ethnic origin, and social economic status.

Organization of the Remaining Chapters

Chapter 2 is a review of the related literature. The topics reviewed are advance organizer, metacognition, adult learning, and computer anxiety. Chapter 3 contains procedures followed in the two experiments conducted in this research project. Chapter 4 presents the results from the investigation of the effects of the SISRO learning strategy in the two experiments. Chapter 5 contains a discussion of findings and implications from the two experiments and suggests future possible studies.

CHAPTER 2
REVIEW OF THE LITERATURE

Introduction

In the previous chapter, the SISRO learning strategy was described in terms of the information processing theory, a commonly accepted learning theory in education, psychology, and computer science (Andrews et al., 1986; Rosenbloom & Newell, 1988). The SISRO learning strategy draws its legitimacy from both information processing instructional theory and cognitive theory of learning. This combination helps to strengthen the generalizability and validity of SISRO. Because instructional practices and learning theories alone cannot predict or support student learning, the combination should be useful in the future (Robinson, 1969). Carnevale, Gainer, and Meltzer (1991) stated,

> We should pay attention to learning theory even though we are engaged in training. Because experience and research demonstrate that when learning theory is embedded in subject-specific practical exercises and when skills to enhance learning-to-learn capabilities or techniques in critical thinking are explicitly identified and taught, learner's test scores improve, and learning gains are retained over time and transfer occurs across subject areas. (p. 42)

The concept of the **Advance Organizer** is the first major element of the SISRO learning strategy. It comes from the information processing theory, a subset of the cognitive view of learning. The second major element of SISRO is **Metacognition** which comes from the cognitive theory of learning. These two elements have been successfully combined to support successful learning strategies in reading (Groller, Kender, & Honeyman, 1991; Honeyman & White, 1987; Jerrolds, 1985). While the description of the SISRO learning strategy in Chapter 1 was described in cognitive terms, the researcher has not explored SISRO's specific educational foundations, its application to any population, or its effectiveness in psychological and pedagogical terms.

In this chapter, the first section will define and discuss the SISRO's advance organizer element. The second section will define and discuss SISRO's metacognition element. The third section will describe the characteristics of the adult learner, for whom SISRO was developed. The fourth section will define and describe computer anxiety and how SISRO may have a measurable effect on reducing it in adult learners.

Advance Organizer

The advance organizer was developed by David Ausubel in the late 1950s and early 1960s to help students more effectively understand and retain large amounts of information provided in lectures (verbal learning) (Ausubel, 1960, 1963; Ausubel & Fitzgerald, 1962; Ausubel, Robbins, & Blake, 1957). The basic premise behind the advance organizer is the cognitive concept of memory structure. According to Ausubel (1960), for new knowledge to be retained and understood, it must be subsumed under existing general principles in the student. Ausubel (1963) said,

> The most efficient way of facilitating retention is to introduce appropriate subsumers and make them part of the cognitive structure prior to the actual presentation of the learning task. The introduced subsumers thus become advance "organizers," or anchoring foci, for the reception of new material. In effect, they provide an introductory overview at the appropriate level of conceptualization. (p. 29)

The efficacy of using knowledge structures to enhance learning did not begin with Ausubel nor is he alone in advocating linkages, in some formal procedure, between old and new knowledge and structures. Aristotle proposed that memory [knowledge] is a set of ideas with associations with other ideas (as cited in Travers, 1982). Aristotle also said these associations of ideas followed the laws of similarity, contrast, and contiguity. He believed that people learn and remember those things which are alike, which are striking because of their differences, and which occur together in space and time (Murphy, 1949). Edward Thorndike (1913) described learning as the formation of connections between one mental fact and another. Travers (1982) described Piaget's schema theory as similar to Ausubel's advance organizer theory. According to Travers (1982), Piaget said the best way to remember information is to have the information organized. Bruner (1966a) believed the search for the structure of knowledge is fundamental to understanding, retention, and transfer. Bruner (1966b) believes each discipline has its own way of thinking. He said, "In a word, the best introduction to a subject is the subject itself" (p. 155). Gagne and Glaser (1987) defined a schema as a "modifiable information structure that represents generic concepts stored in memory" (p. 69). Gagne and Glaser (1987) believed, "As they [students] learn and continue to perform a task, individuals develop efficient and flexible models that are determined by their experience and what they need to do" (p. 71). What sets Ausubel's advance organizer apart from other learning approaches is his strong belief, incorporated in the advance organizer, in the importance of previous knowledge. He said,

> If I had to reduce all of educational psychology to just one principal. I would say this: The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly. (Ausubel, 1963, p. vi)

Ausubel (1968) contended the advance organizer's principal function is "to bridge the gap between what the learner already knows and what the learner needs to know before he or she can successfully learn the task at hand" (p. 148). Ausubel (1968) said advance organizers work because they "draw upon and mobilize whatever relevant anchoring concepts are already established in the learner's cognitive structure" (p. 137). He suggested that an advance organizer provides for anchoring new information under relevant propositions that have been established earlier.

Creation of those relevant propositions by teachers is the first step in effective use of advance organizers. Weil and Joyce (1978) said, "The teacher must organize a sequence of knowledge and present it in such a way that ideational anchors are provided" (p. 206). The advance organizer, created by the teacher, does not have to be perfect. Weil and Joyce (1978) stated,

> [T]he absolute accuracy of the hierarchy is probably less important to meaningful verbal learning than the fact that the teacher is operating on the basis of some reasonable hierarchy in presenting the sequence of learning tasks. (p. 207)

From its beginning in the late 1950s, the advance organizer gained popularity in many research studies and projects throughout the 1960s and 1970s (Jerrolds, 1985). From various meta-analysis studies, the efficacy of the advance organizer has been mixed (Groller et al., 1991). Luiten, Ames, and Ackerson's (1980) meta-analysis of 135 studies involving the use of advanced organizers showed significant results. They concluded, "The findings indicate that advance organizers facilitate learning in all content areas examined, albeit broadly defined, and with individuals from all grades and ability levels" (p. 217). Although Barnes and Clawson's (1975) meta-analysis of 32 studies showed "no clear patterns emerged regarding the facilitating effects of advance organizers" (p. 651), Foss, Rosson, and

Smith (1982) found in this study that the use of an advance organizer had only marginal effects. Anderson, Spiro, and Anderson (1978) believed the reason for the lack of effectiveness of advance organizer is that the procedure for creating and implementing an advanced organizer, as described by Ausubel, is "hopelessly vague." Ausubel (1978) replying to his critics said,

> Apart from describing organizers in general terms with an appropriate example, one cannot be more specific about construction of an organizer; for this always depends on the nature of the learning material, the age of the learner, and his degree of prior familiarity with the learning passage. (p. 251)

David Ausubel (personal communication, spring, 1989) further defended his advance organizer by saying, "[O]ne must understand how to create a true advance organizer. It is not just a summary or an outline!" Jerrolds (1985) believed the reason for mixed results in the studies using advance organizers was "the huge discrepancy among the researchers' levels of sophistication in handling Ausubel's theoretical constructs and their translation of the constructs into appropriate advance organizers" (p. 75).

Another criticism of advance organizers has been the idea that they promote passive learning rather than active involvement by the learner (Van Tassel-Baska, 1988; Weil & Joyce, 1978). Joyce and Weil (1986) contended that Ausubel's description of meaningful learning assumes the learner is actively trying to internalize and structure new knowledge

Speaking specifically about the active versus passive nature of the advance organizer, they stated,

> The more w teach students to become active--to *look* [italics supplied by the book's authors] for organizing ideas, reconcile information with them, and generate organizers of their own--. . . the greater potential for profiting from presentations becomes. (p. 82)

Use of advance organizers has not been limited to any subject or grade level. For example, it has been used with widely diverse disciplines as reading (Groller et al., 1991), science (Graber, 1972) and computer science (Foss et al., 1982; Gopher, Weil, & Siegel, 1986; Jamar, 1986; Mayer, 1976). Ausubel believed, "[Advance] organizers are subject area free, and age free" (Ward, 1989). Jerrolds (1985) and Weil and Joyce (1978) agreed with Ausubel concerning the flexibility of the use of advance organizers with a variety of disciplines.

Due to the hierarchical nature of learning software programs, SISRO was constructed to reflect a higher level of abstraction for understanding the operational and environmental details necessary initially to learn the use of software applications. It was believed the five-question approach (SISRO) correctly subsumes the highly divergent processes each site and/or software package may require. Finding common categories for the different process details of software seems to match Ausubel's requirement for creating a reasonable number of subsuming categories (Ausubel, 1963, 1978; Weil & Joyce 1978). In doing so, a valid advance organizer has been created based upon the author's understanding of Ausubel's explanation of developing a true advance organizer and a review of the relevant literature.

Creating a conceptually sound advance organizer alone does not guarantee learners will learn (Anderson et al., 1978; Graber, 1972; Jerrolds, 1985). Many researchers believe for an advance organizer to be effective it must be presented in such a way that it actively and directly engages the learner in understanding the implications of the advance organizer as it is being initially utilized and presented (Groller et al., 1991; Jerrolds, 1985; Joyce & Weil, 1986; Weil & Joyce, 1978). In other words, learners must be very conscious of the advance organizer process while using it.

The next section of the review of the literature will address the concept of metacognition. From this review, an understanding and use of some form of metacognition will be linked to use of the author's advance organizer, SISRO. This linkage should increase the chances of the SISRO learning strategy being successful.

Metacognition

An increasing interest in learning strategies has occurred with the shift of orientation from the behaviorist view of learning to the cognitive view of learning (Weinstein & Mayer, 1986). Today, psychologists see the learner as a goal-oriented intelligence who constructs knowledge rather than absorbing it (Lesgold & Glaser, 1989). For efficient learning to occur, the learner must be actively engaged externally and internally (Ausubel, 1968; Bruner, 1985; Vygotsky, 1978). Researchers Salomon, Perkins, and Globerson (1991) found in reviewing recent research that "mindful engagement in a task makes learners mobilize more of their intelligence, generate more novel inferences, and commit more of the material [task] encountered to memory" (p. 4). Estes (1989) described cognitive learning as actively directed, selected, and relatively rapid. Armbruster and Anderson (1981), Glaser (1988), and Marshak and Burkle (1981) believed that for students to be successful learners they must use strategies.

Metacognition is the term used to describe those strategies which learners may use consciously to process a task or help remember new information. Brown et al. (1983) believed metacognition has its roots in the information-processing theory, specifically the notion of executive control. John Flavell, described by some as the father of the concept of metacognition, worked with others in the 1970s on developing it (Manning, 1991). Flavell (1987) first used the term meta-memory and meta-comprehension to describe those mental processes associated with consciously working through a procedure or internalizing new knowledge. Flavell (as cited in Manning, 1991), described metacognition as "knowledge and cognition about cognitive, affective, perceptual, or motor human characteristics" (p. 22).

Armbruster and Brown (1984) referred to metacognition as both the knowledge and regulation of cognition. Baker (1982) described metacognition as "a two faceted process: (1) an awareness of strategies needed to perform a task; and (2) an ability to employ such self-regulatory skills as planning, evaluation, checking and self-correcting" (p. 27).

A search of the literature revealed general support for the use of metacognition by students and teachers in classrooms. Pea (1988), discussing cognitive skills, said, "Cognitive studies . . . reveal that such skills [cognitive self-management skills] do exist, can be taught, and are transferred to new materials and domains of study" (p. 191). Brown, Campoine, and Day, (1981) contended that "learners need to be aware of the underlying cognitive processes of the learning tasks, and the importance of applying problem-solving strategies to enhance learning" (p. 14). Flavell (1987) proposed teachers model, teach, and encourage metacognitive activity with their students. Sheinker and Sheinker (1982) called for teachers to foster metacognitive strategies in their classrooms. Sheinker said,

> This meta-cognitive approach can provide the student with effective generalized study strategies which s/he will use again and again if the teacher is careful to provide adequate demonstration, explanation and repetition. (p. 6)

Cardinalli (1992) stated, "Teachers can foster the development of self-directed learners by incorporating a variety of strategies. Techniques such as visual imagery, . . . metacognition . . . " (p. 2).

There is wide support for using discipline-specific cognitive strategies within the context of each subject area. Harker (1981) believed study strategies are content specific, and they must be taught simultaneously. Glaser (1984) said, "There is no teaching of thinking skills in isolation from a knowledge base, nor is a knowledge base developed without a dynamic, thinking type of instruction with content" (p. 893).

Gott (1989) and Bovair (1984), as cited in Glaser (1990), found that training studies showed "procedure skills were effectively acquired in the context of a supporting mental model" (p. 37). Dillon (1986) said, "The effective design and implementation of the instructional experiences centers on the nature of the knowledge within the discipline" (p. 2). Further, the *Task Force on Teaching of Learning Strategies and Thinking Skills* urges a close coupling of teaching higher mental skills with the teaching of conventional content, in the book Excellence In Our Schools: Making It Happen, published by the College Board Examination Board, New York. Finally, Armbruster and Anderson (1981) believed that "content material governs the selection of appropriate strategies and therefore is an intrinsic part of the acquisition of content information" (p. 154).

Mathematics, science, and reading are disciplines where metacognitive learning strategies have been used (Glaser, 1988). Jeeves and Greer (1983) found support for a structured learning approach in a series of math context experiments. Manning (1991) noted several science metacognitive studies (Bereiter & Bird, 1984; Fisher & Lipson, 1986; Hawkins & Pea, 1987) in which self-regulation and thinking-out-loud strategies were used. Sheinker and Sheinker (1982) conducted a study using metacognitive strategies in teaching reading. They found the students' reading scores improved significantly. Groller et al. (1991) found that use of advanced organizers and metacognitive strategies yielded significant differences in the recollection of reading materials.

In the area of computer literacy, Waern (1993) suggested that different learning approaches are called upon to use a computer as a tool. She said, "Thinking about the rules to follow to master a computer program involves both problem solving and concept learning" (p. 324). Salomon et al. (1991) found students demonstrated improved efficiency in the use computer tools when they were consciously engaged in their use. They said,

> We notice that cognitive effects with computer tools greatly depends on the mindful engagement of learners in the tasks afforded by these tools and that there is the possibility of qualitatively upgrading the performance of the joint system of learner and technology. (p. 2)

The SISRO learning strategy, in essence, is based upon the belief that structured knowledge consciously explained, understood, and utilized provides the learner with a strategy for learning how to use new software packages. Baker's (1982) two-part definition of metacognition seems to describe the major elements of the SISRO learning strategy. The first part of Baker's definition of metacognition calls for a structured strategy. The highly developed structural presentation method (an advance organizer) of the SISRO learning strategy seems to match it well. The second part of Baker's definition of metacognition calls for use of self-regulatory skills. Constantly self-checking and monitoring where the user is in the SISRO process serves as navigation cues. Repeatedly noting previous similarities between computer software procedures corresponds with the second part of Baker's definition of metacognition. Another metacognitive element of the SISRO learning strategy is the mnemonic SISRO itself. It is used as a memory cue for the user to recall easily the five fundamental procedures most software programs have. Mnemonics is a form of coding, which, according to Baddeley (1976, as cited in Jeeves & Greer, 1983), is a cognitive process. In summary, the SISRO learning strategies' metacognitive elements seem to be well matched to accepted definitions of metacognition.

The next section of the review of the literature will address the issue of adult learning. There are some unique connections between adult learning and advance organizers and metacognition which the SISRO learning strategy uses. Cacioppo and Petty (1982) believed that adults have a general tendency to be mindful information processors. Adults, according to Smith (1982), use metacognitive practices extensively, so much so that Smith calls the adult use of metacognition, mathetics. Brookfield (1987) describes Smith as an advocate of teaching learning-how-to-learn strategies. Brookfield said,

> R.M. Smith has spent the past two decades developing a theory and practical repertoire of training exercises premised on the idea that it is as important to teach adults how to learn as it is to specify particular domains for learning. (p. 64)

Additionally, adults, according to Carnevale, Gainer, and Meltzer (1990), like to see the big picture (overall structure) before moving on to details. Adults seem to have an attraction to structured mindful learning strategies. Therefore, an exploration of the characteristics, the ways of learning, and the potential anxieties associated with successful adult learning now follows.

Adult Learning

Adult learners present challenges and opportunities for adult educators that are different from educators of primary and secondary learners. Farah and Kosslyn (1982) and Spille, Galloway, and Stewart (1985) believed that children and adults learn concepts in different ways and need different approaches. Cross (1982) found in her research about adult learning that the part-time and volunteer nature of adult learning are the two characteristics which sharply differentiate adult learning from children's learning.

Current learning theories are related to children's development. Maslow (1968) said, "Ninety-nine percent of what has been written on so-called learning theory is simply irrelevant to a grown human being" (p. 175). He further states, "The far goals for adult education are the processes, the ways in which we [teachers] can help people to become all they are capable of becoming" (p. 175).

Andragogy is the term used to describe adult learning. Malcolm Knowles is acknowledged as the educator who has popularized the term in this country (Cross, 1982). Knowles (1970) defined andragogy as "the art and science of helping adults learn" (p. 38). Andragogy, just like pedagogy, the study of children's education, has an established set of beliefs that are commonly accepted by most educators. Drawing from its European roots, Knowles (1980) has described andragogy as "simply another model of assumptions about learners to be used alongside the pedagogical model of assumptions" (p. 43). The four assumptions posited by Knowles (1980) about adult learners are summarized as follows: (a) Adults seek to be self-directed in learning; (b) adult's experiences are a rich resource for learning; (c) adults are aware of their specific learning needs; and (d) adults are competency-based learners. A search of the literature found a wealth of comments and research findings on each of Knowles' four assumptions.

Self-direction for adults means their preference to be in charge of their lives and responsible for the decisions they make (Carnevale, Gainer, & Villet, 1990c). Knowles (1975) defined self-directed learning as a process in which individuals take the initiative in designing learning experiences, diagnosing needs, locating resources, and evaluating learning. Adult educators, according to Knowles (1970), can help facilitate the self-directed goals of adults by showing them the nature of learning a task and providing encouragement and ways to overcome interference with their learning. Indeed, Buettner (1991), in a study of adults' perception of their own power versus powerlessness in learning situations, found that adults who felt in control did better than those whose self-reported power was less. Brookfield (1987) said that the development of self-directing capacities is the most articulated aim of adult educators and trainers.

Adults use their previous experiences extensively to solve problems. "There is a general trend [among adults] toward accuracy and dependence on previously learned solutions in the place of higher-risk behavior and trial and error associated with more youthful learners"(Cross, 1982, p. 167). Brookfield (1987), speaking about an adult's previous experience, says, "The previous learning that has taken him or her to a certain point will perform a mediatory function with regard to new stimuli" (p. 48). Bruner (1966, as cited in Kidd, 1973, p. 180), described a person's education as his or her "experiences reorganized." Experiential learning is so much a part of adult education that David Kolb developed a learning theory called the experiential knowledge theory to describe it. He describes the model of experiential learning as a four part cyclical process, starting with existing experiential knowledge, followed by observation, reflection, and finally concept formation. The newly formed concepts then lead to choices of new experiences (Kolb, 1984). Since each adult's set of learning experiences is different, it should not be surprising that a large number of adults do not naturally follow a direct and sequential path to learning. Gueulette (1982) stated that as much as one-half of the population learn nonsequentially. Danis and Tremblay (1985) contended that adults do not always learn in a linear manner. Contrary to the belief that adults learn by following predetermined and linear steps of problem solving, Danis and Trembley (1985) stated, "Self-taught adults proceed in a heuristic manner within a learning approach which they organize around intentions, and redefine and specify without following any predetermined patterns" (p. 131). Further, adults reported to Danis and Tremblay that random, accidental events are often significant in choosing new learning paths. This penchant among adult learners to use previous experiences presents a challenge to adult educators who must structure new information in such a way that it can be assimilated into the broad range of the learners' previous experiences. Carnevale, Gainer, and Meltzer (1990a) recommend that adult educators move from general to specific. They stated, "The initial introduction of general materials helps learners apply their current level of knowledge and skill to the situation. This serves to make new material more meaningful and easier to remember" (p. 6.3).

Adults are conscious of what learning needs they have to meet real life tasks and problems. Aslanian and Brickell (1980, as cited in Hankin, 1992), stated, "Each time they [adults] get hired or fired, get married or divorced, have children, get sick, or move to a new city, a need to learn is participated" (p. 40).

Hankin (1992) said the goal of community colleges is to be viewed by adults as a prime source of training and learning. His argument has merit. For adults over 25 years of age, enrollment in community colleges today averages 40% of current enrollment and will reach 50% by the year 2000 (Hankin, 1992). According to Carnevale et al. (1990a), community colleges and technical institutions provided qualifying technical training to over 1.6 million students and upgrading training to 760,000 technical workers in 1985. As an example of this technical awareness and need, Prete (1991) found adults often feel learning about computers gives them a second chance and a set of technical skills many college graduates do not have. Ward (1989) found in a study of why adults took computer literacy courses that learning about computers is viewed as needed by all adults but for different reasons based on social class. Specifically, low socioeconomic students viewed computer literacy as a ticket out of poverty, while high socioeconomic students viewed computer literacy as a tool to be more productive.

To assist adult learners in defining their learning needs, an adult educator should help them define those needs in terms of immediate awareness and of understanding the cultural and psychological assumptions influencing his or her perceptions of those learning needs, according to Brookfield (1987). This call for adult educators to assist learners in defining their educational needs means the role of adult educators must change. The biggest change will be a stronger emphasis on improving the learners' self-confidence. Cardinalli (1992) said,

> Providing opportunities for students to gain confidence in their own thinking processes, observation skills and problem solving abilities reinforces their values in becoming self-directed learners and assertive participants in their experiences. (p. 2)

Adults will increasingly encounter in the workplace pressure to update a wide variety of their work skills. Kearns (1987) and D'Ignazio (1990), as cited in Schell and Hartman (1992), predicted workers in the future must be prepared for change and flexibility in their workplace. For example, workplaces of the future will require adults to be partners with technical tools (Salomon et al., 1991). It seems logical that among those needs will be generalizable and transferable technical skills. Understanding and comprehension of learning-to-learn skills would reduce the need for additional training time and subsequently increase productivity. According to Carnevale et al. (1991), "many employees, particularly those dealing with rapid technological change, have come to see the learning-to-learn skill as an urgent necessity for their workers" (p. 18). Schell and Hartmann (1992) called for a shift in vocational training from teaching simplistic and fixed procedures to teaching flexible cognitive structures which allow the user "to hypothesize, diagnose and solve the problem" (p. 44). Rand Spiro (1980, as cited in Schell & Hartman, 1992), defined flexible cognition theory as "the ability to restructure spontaneously one's knowledge . . . in adaptive response to radically changing situational demands" (p. 41). Finally, Salomon et al. (1991) believed transferrable mindful abstractions about technology cannot be expected to occur in adults without deliberately fostering those abstractions through activities. The advance organizer and metacognitive elements of the SISRO learning strategy seem to fill the requirements of Spiro and Salomon et al. for a flexible cognitive approach to be taught to adults.

Adults are competency-based learners. They wish to be able to apply immediately newly acquired skills and knowledge. Darkenwald and Merriam (1982) stated, "This intimate relationship between learning and living is in our view the hallmark of adult education" (p. 124). Adults' desire to have relevance in their coursework may be a reaction to their perception of the lack of relevance of their own childhood education to the problems they encounter now as adults. Pea (1988) found that "extensive research generally revealed meager connections between what was learned in school and everyday life problem-solving" (p. 172). According to Viechnicki (1990), "most adult students reported that instruction should be relevant to their lives and/or their professional career" (p. 10). Powers (1991) found in a year-long study of a community college continuing education computer institute that the top reason students selected courses was to improve job-related skills. The top choice was word processing. Over 64% of the respondents chose WordPerfect, a word-processing program, as the most the desired software package to be learned.

Obviously with this strong call by adults for immediate utility, adult educators have a different challenge than educators of the young. Knowles (1978), speaking about the differences between the adult student and the child student, said,

> Children have been conditioned to have a subject-centered orientation to most learning, whereas adults tend to have a problem-centered orientation to learning. This difference is primarily the results of the difference in time perspective. The child's time perspective toward learning is one of postponed application.

> The adult, on the other hand, comes into an educational activity largely because he is experiencing some inadequacy in coping with current life problems. He wants to apply tomorrow what he learns today, so his time perspective is one of immediacy of application. Therefore, he enters into education with a problem-centered orientation to learning. (p. 58)

Suanmali (1981, as cited in Brookfield, 1987) called for adult educators to utilize experiential, participatory and projective instructional methods and use modeling and learning contracts. The SISRO learning strategy was developed to have three elements that were especially helpful for adults: hands-on practice, constant teacher monitoring of the classes' progress through the mnemonic SISRO, and regular summaries. Learning strategies can include mnemonics as a cognitive strategy activator (Reigeluth, 1987). Frequent summaries should facilitate retention and recall (Cross, 1982).

Adults can be flexible in their learning environments and learning styles. Brecht (1978, as cited in Cross, 1982) found that adults taking evening classes wanted tightly structured traditional programs, and Amador (1986) found hands-on computer workshops to be most attractive to adults. Yet, Korhonen and McCall (1985) found no differences in adult levels of learning when learning styles of adults and learning environments were correlated with achievement levels in a computer programming course. Dixon (1985) believed preferred learning styles do "not imply that these are the only or perhaps best ways for the individual to learn a given subject matter" (p. 16). Conti and Welborn (1986) suggested adult learners have the ability to adapt to a variety of learning methods. Adults can and do change their methods of learning at different stages of their lives and careers (Carnevale et al., 1991). It seems that adults are resilient and adaptable enough to adapt to varying educational settings and use of different learning styles.

The workplace today is the driving force in adults' lives. It will demand that adults have increasing contacts with lifelong and varied learning situations to stay productive. For the economy to continue to be competitive, demands for adults to be technically literate are increasing. According to Carnevale, Gainer, and Villit (1990c), "Advances in information-processing technology have been the major source of changing skill requirements in most American jobs" (p. 84). Naturally, these demands for increasing technical competence are stressful upon adults. "People are more likely to be technophobic if they were introduced to technology under stressful conditions" (DeLoughry, 1993, p. 27). In the next section, computer anxiety and its subsequent effects will be defined. Additionally, what strategies have been and can be used to reduce and ultimately eliminate computer anxiety will be discussed.

Computer Anxiety

In this section, the relationship between anxiety and learning is explored with a particular focus on computer anxiety. "Anxiety is "something felt"--a specific unpleasant emotional state or condition of the human organism that includes experiential, physiological, and behavioral components (Freud, 1936, as cited in Spielberger, 1983). Spielberger (1983) further defined anxiety with two constructs called state anxiety and trait anxiety. State anxiety is a temporary condition brought on by outside influences; trait anxiety is a rather permanent condition based on the disposition and personality of the individual. Phillips, Martin, and Myers (1972, as cited in Honeyman & White, 1987) found the consequences of a high state anxiety are complex, and they are usually negative and debilitating. Anxiety can manifest itself physiologically. Brain research has found physical changes occur when high anxiety is present. Specifically, Hart (1978) stated that the neocortex shuts down under pressure or threat. "In its lesser forms, it [anxiety] can make people uncomfortable, self-conscious, and inefficient" (DeLoughty, 1993, p. 27). Sieber et al. (1977) called anxiety "unpleasant and painful" (p. 75). The anxiety can range "from slight apprehension to almost paralyzing fear" (Martin, 1990, p. 2).

The connection between anxiety and learning is not a new phenomenon. Anxiety often occurs in the school environment.

The origins of modern educational research about the effects of anxiety on learning can be traced, in part, to the Taylor Manifest Anxiety Scale developed by J. Taylor in 1953. This validated instrument measures, through self-reporting responses, overt symptoms of emotionality (Taylor, 1953). Taylor's work laid the groundwork for future studies and instruments relating anxiety to other psychological factors (Sieber et al., 1977). John Kidd (1973) reported that "there are a growing number of studies that show the relationship between anxiety and tension and learning" (p. 99). Sieber et al. (1977) said, "It is . . . not surprising that high anxiety interferes significantly with the ability of students at all educational levels to profit from instruction" (p. 75). Anxiety affects people in and out of school. Selfe, (1992) believed, "Increasingly, employees, students and teachers are required to learn computer systems quickly and under stress" (p. 19). A number of studies and researchers (Bandura, 1977; Betz and Hackett, 1983; Crichton, 1983, as cited in Kaye, 1983; Emery, 1986; Heinssen, Glass, and Knight, 1987) found computer anxiety to be associated with math anxiety. Bores-Rangel, Church, Szendra, and Reeves (1990) reported that these anxieties can affect an individual's career or college major choices. Career choices based on fear, frustration, and anxiety can have major effects in our society long after the initial cause is no longer present. Choice of a profession which may seem safe from technology cannot be guaranteed.

The teaching profession has not been immune to the increased use of computer technology in school classrooms. The manner in which teachers conduct their teaching in the classroom is not immune from anxiety either. Selfe (1992, as cited in Troyer, 1988) reported, "The fear that the computer will undermine their profession by taking over the teaching function is widely held by many teachers" (p. 148).

Anxiety also occurs in the workplace. According to Martin (1990), "There is a growing body of knowledge that [worker] concerns about computing do influence performance" (p. 2). Locus of control is important to adults, and loss of it through the introduction of computer technology can cause anxiety with subsequent negative effects.

> The fear that accompanies an individual's perception that one's life is being affected by events they cannot control, coupled with a generalized fear of technology, can result in high levels of frustration and anxiety. (Honeyman & White, 1987, p. 129)

Jackson (1987), commenting on the negative effects computers can have in the workplace, stated,

> The computer system not only structures the tasks of some employees so that there is little room for initiative, but the monitoring function of the system tends to increase employee fears of detection of their deviation from prescribed practices. (p. 252)

Consequently, computer phobias and resistance may result from introducing computer technology into the workplace without proper support and preparation. This support and preparation must have as one of its goals giving the person a feeling of power (Jackson, 1987). Bandura (1988, as cited in Mager, 1992), speaking about self-efficacy [self-confidence], said,

> People who have a strong belief in their capabilities think, feel and behave differently from those who have doubts about their capabilities. People who doubt their capabilities shy away from difficult tasks. (p. 32)

In short, no self-efficacy, no performance (Mager, 1992). Adults who learn to understand and use computers will have control of information and power to control their own lives and the lives of others (Scheck, 1985).

Anxiety, in particular computer anxiety, is not age- or gender-correlated; rather, it is experience correlated. Researchers involved in computer-anxiety studies (Corbin, 1986; Heinssen et al., 1987; Jordon & Stroup, 1982; Lewis, 1988) found no significant correlations between anxiety and age or gender. Rosen and Weil, as quoted in DeLoughry (1993, p. 27), said, "The higher levels of technophobia among women and older people are simply the result of their having less exposure to technology." Lewis (1988, p. 5) concurred, stating that one's tenure on the job where computers are used is the only significant variable in one's anxiety, not the one's age or gender.

General and specific proposals and studies were found in the literature for reducing or eliminating computer anxiety and the consequences of computer anxiety, such as decreases in self-efficacy, self-confidence, or self-direction. Researchers (Brookfield, 1987; Cross, 1982; DeLoughry, 1993; Elias, Penelope, Robbins, and Gage, 1987; Jordon and Stroup, 1982; Lopez, 1974; Mruk, 1984; Stanley, 1989) reported allowing more time in class or on the job for practice with computer software was the most popular solution. Rosen and Weil (as cited in DeLoughry, 1993) use counseling and relaxation techniques to reduce anxiety. Allen (1984), Hart (1978), and Lewis (1988) called for instructors to confront anxiety openly in their presentations and promote a relaxed nonthreatening atmosphere in the classroom. Corno (1987, as cited in Manning, 1991), Cross (1982), Daloz (1986), Novak (1990), Palmer and Goetz (1983), Sieber et al. (1977), and Tomlinson (1981) reported presenting information, processes, or specifically new software in systematic, structured, efficient, and/or metacognitive ways as a another solution to eliminating anxiety's effects. The SISRO learning strategy's advanced organizer and meta-cognitive elements were partly developed from these citations. One of the causes of computer anxiety is that the functional steps to use a software package are not completely conventional from one package to another. "Users never get a chance to become familiar with a set of conventions because the conventions keep changing" (Grice, 1989, p. 36). The author's intent was to impose a standardized structural convention on new application software in a conscious manner and thereby help reduce the frustration and anxiety users encounter with new software application packages.

Surprisingly, the presence of some anxiety may be of some educational value when the SISRO learning strategy is introduced. Goulet (1968), Sarason, Mandler, and Craighill (1952), Spence and Spence (1966), and Travers (1982) reported that anxiety with simple tasks actually enhances learning by heightening alertness. Sieber et al. (1977) found providing memory support to high anxious students helped decrease mathematical computational errors. Since the mnemonic SISRO is a simple memory tool, and it is part of the SISRO learning strategy, it may actually facilitate the learner's initial progress through a software package during a time of raised levels of state anxiety.

In summary, treatments for computer anxiety are complex, and each one must include educationally and psychologically proven elements.

> Ideal treatments are those which alter the anxiety process in ways that must fully meet educational objectives--that produce highly motivated, self-confident, competent, innovative problem solvers as quickly and conveniently as possible. (Sieber et al., 1977, p. 44)

What follows in Chapter 3 are the details of implementing such a treatment.

Traditional learning strategy group and the SISRO learning strategy group.

The Traditional learning strategy group, which consisted initially of 67 students, was taught by teachers who used traditional methods to teach students the beginning computer course. The SISRO learning strategy group, which consisted initially of 63 students, was taught by teachers who had agreed to teach their classes the SISRO learning strategy necessary to comprehend the basic operations of software programs. To learn the teaching techniques necessary to use the SISRO learning strategy with their classes, the SISRO learning strategy group teachers agreed to attend the same 3-hour workshop previously described as did those of Experiment One.

A major component of the beginning computer classes is the introduction to software packages students will encounter in their everyday lives. Word processing, spreadsheet production, and database production are the three most commonly introduced software packages, with word processing leading the other two as the most immediately useful and understandable.

An extra credit exercise, involving word processing and under the supervision and direction of the author, was offered to both the Traditional learning strategy group and SISRO learning strategy group within 2 weeks of their regular class exposure to and practice with the word-processing colleges seem to be more representative of the society at large than younger age adults. Cross (1982) also found older students appeared to have more clearly defined goals for taking courses and are slightly more confident in their abilities to succeed. Since an older population was being sought, only evening beginning computer classes were used. The groups of classes were chosen based on convenience sampling. Through the cooperation of the coordinator of the computer and information science department, volunteers were sought from the teachers of the approximately 16 sections of the evening beginning computer courses offered during the fall of 1992.

Once the two groups of classes were selected, administration of a precourse survey during the second week of the semester to the two groups of beginning computer college classes was completed. The survey collected basic demographic data and student preferences for future computer courses and inclination to learn software packages independently. Additionally, the initial administration of the STAI occurred during the second week of the term. This early administration during a 15-week semester established the homogeneity of the two groups and initial levels of anxiety for the groups by comparing the beginning S scores. A *t*-test found no significant difference between the groups. The two groups henceforth will be labeled the

The typing speed measure and self-reported previous computer experience was used in conjunction with the student's elapsed time measures and number of questions asked for completing the two parts of the exercise to define the differences between the Traditional learning strategy group and the SISRO learning strategy group.

The following measures were recorded: percentages of each group who attempted the exercise, typing speeds, previous computer experience, time elapsed, and number of clarifying questions for the two parts of the exercise. The three STAI STATE (S) mean scores measured over the term of the Traditional learning strategy group and SISRO learning strategy group were compared to determine the efficacy of the learning strategy.

Experiment Two

The second experiment began with the selection of two groups of beginning computer classes. The specific name of the course was "Introduction to Microcomputers" (CGS 1000) at Santa Fe Community College, Gainesville, Florida. Historically, students attending evening beginning computer classes are significantly older than college students taking classes during the day. "Adult" students (persons over 30 years of age) differ considerably from traditional college students in their goals, needs, and perceptions of their roles in classroom settings. Cross (1982) found from a review of several studies that older adults in community it. The time to complete part I, as well as the number of clarifying questions of the author, were recorded. Although part I did not have a time limit, its expected completion was 10 minutes. Part I's structure was designed to measure the efficiency and the self-direction of the learning strategies used by the students.

Part II required the student to use WordPerfect 5.1 to retrieve the short paragraph saved in part I, edit it, and then print the updated document. Unlike part I, this section was timed. The students were encouraged, through oral instructions, to complete Part II in 10 minutes. Further, asking questions was discouraged, again through oral instructions, unless the students felt strongly they could not proceed. However, WordPerfect 5.1 reference materials were available for student use. The purpose of these changed rules was for the self-directed thinking of the student, drawn from the SISRO learning strategy, to be measured.

Administration of the STAI took place within 1 week after of the completion of the two-part exercise. During the midterm administration of the STAI, the context of the computer exercise was reinstated by giving oral instructions to help them recall the feelings they had while they worked on the exercise. Further, at the end of the term, the STAI was again administered to the Control group, Traditional learning strategy group, and SISRO learning strategy group.

specifics of the computer laboratory, and gave them time to practice. The setting of the SISRO learning strategy group's instruction and extra credit exercise was the same 16-station IBM personal computer laboratory on the main campus of the community college used by the Traditional learning strategy group instructors.

Once the instruction of the students was completed, computer laboratory times were set aside for the students, under the supervision and direction of the author, for the Traditional learning strategy group and SISRO learning strategy group to verify the efficacy of the SISRO learning strategy. The extra credit student exercise occurred during the eighth and ninth week of the term.

Before the computer exercise actually began, each student took a short (1 minute) typing test (Appendix C) to record the number of words per minute each student could type. At the end of the typing test, the results were recorded (Appendix E). Additionally, the student's self-reported previous computer experience was found by orally asking three questions which determined if they indeed had previous computer experience. The results were summarized and recorded as Yes or No (Appendix E). After completing the typing test, the students began the computer exercise (Appendix D).

Part I of the exercise required the student to use WordPerfect 5.1 to type a short paragraph, save it, and print experience, during the sixth or seventh week of the term. The instructors used traditional teaching techniques and strategies to teach the basic operations of the word-processing software program, WordPerfect 5.1, to their classes. The setting of the instruction was a 16-station IBM personal computer laboratory on the main campus of the community college. The Traditional learning strategy group instructors were provided time to familiarize themselves with the operational specifics of the hardware in the 16-station IBM laboratory.

The SISRO learning strategy group, consisting initially of 116 students, was shown how to use a word-processing package by instructors of their college success course, who happened to have previous word-processing experience, during the sixth or seventh week of the term. Unlike the Traditional learning strategy group's instructors, who used traditional teaching techniques and strategies to teach the basic operations of the word-processing program, WordPerfect 5.1, to their classes, SISRO learning strategy group's instructors used the SISRO learning strategy (see Appendix A and Appendix B), as previously explained, for understanding the basic operations of unknown software packages. To accomplish this, SISRO learning strategy group's instructors attended a 3-hour workshop where the author explained the learning strategy, the rationale behind it, ways to explain it to students, familiarized them with the operational

1101) at Santa Fe Community College, Gainesville, Florida. The groups of classes were chosen based on convenience sampling. Through the cooperation of the coordinator of the freshman orientation classes, volunteers were sought from the teachers of the approximately 33 sections of the course offered during the Fall of 1992. The initial administration of the STAI occurred during the fourth week of the term. This early administration during a 15-week semester established the homogeneity of the three groups and initial levels of anxiety for the groups. The three groups henceforth will be labeled Control group, Traditional learning strategy group, and SISRO learning strategy group.

The Control group initially consisted of 93 students who were not given the training to use either the SISRO or the traditional learning strategy. They were not involved in demonstrating their computer software competency in any way. The STAI was administered to all three groups again during the 14th or 15th week of the term. The initial and final administration of the STAI to Control group, Traditional learning strategy group, and SISRO learning strategy group served as a baseline comparison for the three groups of classes.

The Traditional learning strategy group, consisting initially of 84 students, was shown how to use a word-processing package by instructors of their college success course, who happened to have previous word-processing populations in different types of courses were conducted. By examining college records (Walsh, personal communication, July 15, 199 2), it was determined that a wide gap in the median age of community college students existed between students taking freshman orientation courses and students taking evening beginning computer courses. The first experiment was conducted with a sample population of college students, whose median age was approximately 22, taking a freshman orientation course. The curriculum of the freshman orientation course was modified to include a 1-hour word-processing software component. The second experiment was conducted with a sample population of college students, whose median age was approximately 33, taking an Introduction to Computers evening course. The curriculum of the beginning computer course by its nature has 45 hours of computer software exposure. These two courses are open entry courses, that is, they do not require any prerequisite courses. Consequently, the students come from a wide range of social, economic, and educational backgrounds. This further ensured the generalizability of the results of the experiments.

Experiment One

The first activity of Experiment One began with the initial administration of the State Trait Anxiety Indicator (STAI) to three groups of freshman orientation college classes during the second week of the Fall semester of 1992. The specific name of the course was "College Success" (SLS of both groups from the initial count who may still have been enrolled in the course at the time of the extra credit exercise but subsequently dropped.

Discussion

The results of the measures taken during the second pilot were mixed; two statistically significant measures out of nine were found. Before the execution of the two experiments, the following actions were taken: The sample sizes for each group for both experiments were increased; several presurvey and postsurvey questions were reworded to clarify their meaning and to be more amenable to statistical analysis; and STAI administration procedures were adjusted to be less time consuming. Finally, to eliminate the potential impact of the author's teaching style as a comfounding variable, none of the SISRO learning strategy groups in the College Success experiment (Experiment One) were taught by the author. Further, the author trained another instructor of the Introduction to Microcomputers experiment (Experiment Two) to use the SISRO learning strategy to reduce the impact of the author's teaching style as a confounding variable.

Introduction to the Experiments

Since the SISRO learning strategy has the potential of impacting a diverse population of individuals in either a short Introduction to Computer workshop setting or in a traditional Introduction to Computer college credit course setting, two experiments with different aged adult

A *t*-test showed a significant difference between the groups in respect to the typing ability of the individuals who attempted the extra credit computer exercise, $t(30) = -2.50$, $p < .05$. Specifically, members of the traditional learning strategy group who attempted the extra credit exercise were better typists than the members of the SISRO learning strategy group who attempted the extra credit computer exercise. This suggests that despite weaker technical skills, the members of the SISRO learning strategy group felt sufficient self-confidence to attempt the exercise. The actual mean measure of the traditional learning strategy group was 2.45 versus 1.81 for the traditional learning strategy group. A self-report, Likert-type scale from 1 (poor typist) to 4 (very good typist) was used to get the above measures. Due to the inherent ambiguity of this measure, the typing measure for the subsequent experiments was changed to a direct objective measure of typing ability which used a words-per-minute typing test.

The chi-square statistic was used to compare each group's percentage of individuals who volunteered to attempt the extra credit computer exercise. No significant difference was found. It was noted, however, that only students in both groups who could be verified to be still in the course sections at the end of the term were included in this measurement. This definition thus eliminated students

it?" An ANOVA, with groups and participation in the exercise as factors, indicated no significant differences across groups, whether individuals in the groups attempted the extra credit computer exercise or not. This finding suggests both groups have equal expectations about their ability to attempt to learn a new software package on their own.

In response to the postsurvey questions (for those who attempted the extra credit computer exercise), **"What was the MOST [or LEAST] skill or action you used to do the exercise?,"** members of the SISRO learning strategy group and the traditional learning strategy group had the following choices:

1. Asking the monitoring teacher specific questions,
2. Looking through the reference manual,
3. Previous word-processing experience,
4. Previous computer software experience,
5. Skills I learned in my present computer course,
6. Previously acquired general organizing skills,
7. Other ________________________ .

A chi-square statistic showed no systematic differences between the groups in the choices they claimed facilitated their completion of the exercise. An examination of the differences of the choices showed "**Looking through the reference manual**" by both groups was the least preferred skill, while "**Skills I learned in present computer course**" was the most preferred skill by both groups. This finding suggests students in both groups equally valued the importance of the learning strategies taught to them in their just completed computer course.

strategy significantly reduced the amount of time necessary to learn and use the previously unknown software package.

Self-Confidence

As previously described, the self-confidence measures were broken into two parts, comparison of responses between presurvey and postsurvey questions and comparisons of the technical ability between groups and comparisons between percentages of each group who showed up to attempt the software task. In response to the presurvey and postsurvey question, **"Rank order and mark the types of classes you plan to take in the near future,"** a simple count of the total number of the types of courses chosen by members of the SISRO learning strategy group and the traditional learning strategy group was made. A repeated-measures ANOVA, with groups and participation in the exercise as factors, showed no significant differences in the number of courses chosen from the pretest survey to the posttest survey across groups, whether individuals in the groups attempted the extra credit computer exercise or not. This finding supported the idea that changes in attitude about types of classes taken in the future are not affected by the teaching strategies of the instructors.

In response to the post-survey question, **"Imagine it is six months from now. You are given an unknown software package to use. How confident are you that ON YOUR OWN you would be able to figure out how to use** administrative procedures used would not present an external validity problem when this measure was used in the two experiments that followed.

Self-Direction

A *t*-test showed no significant difference between the groups in the number of questions asked of the monitoring instructor during the extra credit computer exercise. Since no attempt was made to restrict the number of questions asked during any part of the extra credit exercise, this measure may not directly measure the procedural and structural skills of either group. Breaking the extra credit exercise into two parts, one part with no restrictions on questions and time needed to complete that portion and the second part with some restrictions on questions that will be answered and the amount of time available, should clearly show any differences in the group's self-direction and efficiency.

Efficiency

A *t*-test showed a significant difference in the time used by each group to complete the extra credit computer exercise, $t(30) = -2.65$, $p < .05$. Specifically, members of the traditional learning strategy group took more time to complete the extra credit computer exercise than members of the SISRO learning strategy group. The actual mean times were 38.12 minutes for the traditional learning strategy group versus 26.43 minutes for the SISRO learning strategy group. This measure suggests knowledge of the SISRO learning volunteer members of both treatment groups taking self-confidence, efficiency, and self-direction measures, (d) administered the STAI to only the SISRO learning strategy group just before their midterm and final examinations, respectively.

Second Pilot Study Results

A total of nine quantitative measures were taken for the variables anxiety, self-confidence, efficiency, and self-direction. What follows is a brief description and explanation of the results of those measures, a description of any adjustments made to the measuring instruments, and planned changes in administrative procedures for the instruments.

Anxiety

No attempt was made to collect STAI data from both groups due to the author's primary concern for developing consistent administrative procedures. Therefore, the State Trait Anxiety Indicator (STAI) was given only to the SISRO learning strategy group. The STAI was administered during the third week (midterm) and sixth week (end-term) of the course. A *t*-test on the paired samples showed no significant difference in the State (S) measures between SISRO learning strategy group's midterm and end-term scores of the STAI. Both mean scores, however, were not significantly different from the national norms for the STATE (S) measure (Spielberger, 1983). The results suggested that the classes. Since the author was interested in adult student reactions to the SISRO learning strategy, this population fit well. Indeed, the presurvey confirmed that the average age of the population was approximately 35.

The population was divided into two treatment groups based on the author's interviews of the course section teachers. From this interview process and professional peer recommendations, the selected four teachers were found to be experienced and successful computer science educators who used traditional methods to explain and explore computer software. The four teachers agreed to participate voluntarily. The author (the fifth teacher) would teach the SISRO learning strategy group (one section), while the other four teachers would teach the Traditional learning strategy group (four sections). Since this was a pilot study, no effort was made to keep the numbers in each treatment group balanced.

The following study-related activities were conducted: (a) administered an updated version of the pretest survey and posttest survey to both treatment groups, (b) taught the SISRO learning strategy (see Appendix A and Appendix B) to the SISRO learning strategy group to help them understand the basic operations of computer software, while the Traditional learning strategy group was taught traditional methods to understand the basic operations of computer software, (c) presented an initial version of the computer software task to task. The author found the computer software task was completed by all members of the workshop within a range of from 7 to 15 minutes. Previous typing skills and computer experience seemed to be a factor in the time necessary to complete the computer software task. From verbal comments and written comments on the survey, students reacted favorably to the SISRO strategy. Adjustments to the teacher and student materials and ways of describing and utilizing the SISRO learning strategy were made based upon the feedback from the class.

Second Pilot Study

During the summer of 1992, the author chose five sections of the course Introduction of Computers at Santa Fe Community College, Gainesville, Florida, for participation in the second pilot study. The initial population size was 101. This 3-hour, college credit course was a typical general survey computer literacy course. A large set of computer terms, definitions, and concepts were explained and discussed. Additionally, students were shown and were expected to demonstrate a basic understanding of word processing, spreadsheet, and database software. These sections were chosen based on convenience sampling. In particular, these five sections were selected because they met at night. From previous observations, the students in evening classes were found to be significantly older than the students attending daytime introductory computer literacy

literacy course. A basic set of computer terms, definitions, and concepts were briefly explained and discussed. Additionally, students were shown the basic operations of word processing, spreadsheet, and database software. Fourteen adults, with an average age of 35, took the class. The author conducted the following study-related activities: introduced the SISRO learning strategy (see Appendix A and Appendix B) to the students; tested several procedures for measuring self-confidence, efficiency, and self-direction; and administered the first draft of a survey instrument which would indicate the students' possible future choices of computer courses. All students in the class completed the draft survey which also was used to collect basic demographic data.

First Pilot Study Results

The survey asked the students to choose the number of courses they would consider taking in the near future (within the next year). Sixty-six percent indicated they planned to take one to three more courses, while 34% indicated they planned to take four or more courses. These results correlated closely with the institution's own historical findings (Powers, 1991).

Based upon the survey responses, changes were made to the wording, detail, and sequence of several questions in the presurvey and postsurvey. Observations were recorded showing the time necessary to complete a short computer software postsurvey instruments. Computer anxiety was measured by asking the treatment groups to complete the STAI at regular intervals during a term.

Pilot Studies

Two pilot studies were conducted during the winter and summer of 1992. These two pilot studies served several purposes. They were to refine the STAI administrative procedures, test and refine the SISRO strategy with a small population similar to the experimental population, try out a volunteer computer software task procedure, and allow for clarification and rewriting the pre- and postsurvey questions. The author felt conducting the pilot studies would decrease external validity problems that could occur in the two experiments. Gay (1981) and Kieppel and Zedeck (1989) both advocated the use of pilot studies. Kieppel and Zedeck (1989) believed, "Pilot studies are a form of pretesting" (p. 5). Gay (1981) stated, "Even small-scale pilot studies with small populations help in refining administrative procedures, instrument administration, scoring routines, and trying out analysis techniques" (p. 74).

First Pilot Study

During the winter of 1992, the author taught an Introduction to Computers continuing education course. This 2-day workshop lasted 12 hours. The course was sponsored by Seminole Community College, Sanford, Florida. This continuing education course was a typical adult computer closely matched their self-perception of ability to do that activity and its intrinsic practical value. To measure this self-perception of ability, a presurvey and a postsurvey were administered. These surveys provided demographic data as well as answers to self-perception of ability questions with computer software.

Specifically, self-perception of ability with computer software was measured in four ways: (a) asking students to indicate specific computer courses or workshops they would be likely to take in the future, (b) asking students to indicate specific software packages they would attempt to learn on their own, (c) asking students to indicate, at the end of their current computer course, how confident they are in their ability to attempt unspecified software packages or computer courses, and (d) comparing each treatment group mean percentiles for responses to questions about most and least useful actions in completing the volunteer computer software tasks.

Summary of Measures

In summary, the four indicators of the efficacy of the SISRO learning strategy were measures of self-confidence, efficiency, self-direction, and anxiety. Measurements of self-confidence, efficiency, and self-direction were found by recording the number of participants and their behavior during the computer software task assignment and by the choices they made on the administered presurvey and

Specifically, Weil (as cited in DeLoughry, 1993) suggested from her review of computer anxiety research studies and her own work that the best way to gain confidence in the use of computers is to spend considerable time using them. Naturally, members of either treatment group with previous computer software experience and/or solid typing skills would be more likely to show up to demonstrate their skills. So a second measure of self-confidence would be measuring the differences in the percentages of people in each treatment group who have previous computer experience who chose to participate. Additionally, a third measure of previous experience would be indicated by the typing speed of the members of each treatment group who choose to participate. Familiarity with the keyboard, as indicated by typing speed, is a measure of the amount of comfort the members have with the computer. Buettner (1991) suggested that adults only volunteer to do things in which they have a reasonable chance to have a measure of control and, therefore, succeed. Kidd (1973), referring to the value of time to adults, said, "Investment of time in an activity may be as important a decision as the investment of money or effort" (p. 48).

<u>Self-Confidence: Surveys</u>

Self-confidence can also be indicated by how a person feels about his or her future participation in an activity. Cross (1979) found adult choices for future activities

Self-Confidence

To measure differences in self-confidence, the definition of self-confidence, as explained by Knowles (1970) and Mruk (1984), was used. They suggested adults show their self-confidence by the degree of participation in an activity. Also, adults show their self-confidence by their self-perception of their ability to do a task. Bandura (1986) stated, "A sense of personal efficacy in mastering tasks is more apt to spark interest in them than is self-perceived inefficacy in performing competently" (p. 242). Finally, Barrett (1991) specifically found adults' self-perception of computer ability to accomplish a task indicated their self-confidence. Collecting self-confidence measures from a volunteer computer software task and self-reporting presurveys and postsurveys would provide further strength and clarity to the efficacy of the SISRO learning strategy.

Self-Confidence: Computer Software Task

Measuring the differences in percent of people in the treatment groups who participated in the software task is one indicator of the group levels of self-confidence. The value of this measure could be confounded, however, by the amount of previous computer software experience and/or previous typing experience members of each treatment group already possess. Kolb (1984) suggested in his theory of experiential learning that experience, especially for adults, guides their choices for new experiences.

differences in treatment groups' STATE (S) scores indicated how the SISRO learning strategy affects the anxiety level of the treatment groups.

Self-Direction

Adults desire to be self-directed learners. Carnevale et al. (1990a) stated, "Adults need to be self-directed in their learning. They want to be in charge of their lives and responsible for the decisions they make" (p. 6.6). To measure the self-direction of the treatment groups, group differences in the number of questions asked to complete a computer software task indicated how self-directed the treatment groups are in their computer software learning strategies.

Efficiency

For a learning strategy to be accepted by adults, it must be efficient. Adults are highly pragmatic learners according to Cross (1979). Carroll and Rossom (1987) found that adults are time conscience about completion of tasks. Ward (1989) found the amount of time set aside for learning was highly prized by upper income individuals. One measure would be used to determine if the SISRO learning strategy was efficient. By measuring the treatment group's differences in the amount of time used working with a software package, the time efficiency variable was found.

called such a research strategy the "multioperations paradigm" (p. 24). They stated,

> Only by examining data generated by different researchers, employing different methods and alternative operationizations of the construct can a person accumulate truly scientific evidence about a phenomenon. (p. 25)

Anxiety

While anxiety may be described as a qualitative feature when describing human behavior, several instruments have been developed over the last 25 years which have been proven to be fairly reliable and consistent in quantitatively measuring the level of anxiety a person may exhibit. The State Trait Anxiety Indicator (STAI), developed by Dr. C. Spielberger (1983), is a widely accepted, flexible, correlated, and mature instrument used to measure a person's self-perceived anxiety level. Katkin (1978) described the State Trait Anxiety Inventory as "[a valid measure of] individual differences in transitory experiences of anxiety" (p. 1095).

Spielberger (1983) found over 2,000 archival publications in which the STAI was used to measure anxiety. The STAI consists of two measures: STATE (S) anxiety, which is short term or immediate anxiety, and TRAIT (T) anxiety, which is long term or general anxiety. The STAI instrument was chosen for this study because of its maturity, history of wide use (Spielberger, 1983), and its use in a similar studies, for example, Honeyman and White (1987). By measuring several times over the course of a term, the

CHAPTER 3
METHODOLOGY

This chapter is divided into three parts. The first part of the chapter describes why the measures of the study (anxiety, self-direction, efficiency, and self-confidence) were chosen and the instruments used to measure them. The second part of the chapter describes the two pilot studies conducted and the results of those studies. The third part of the chapter describes how the actual two experiments of the study were conducted.

Measures

Anxiety, as previously discussed in Chapter 2, can be measured via a variety of instruments. Computer anxiety specifically can be measured by such instruments as the <u>State Trait Anxiety Indicator</u> (STAI), the <u>Computer Anxiety Rating Scale</u>, the <u>Computer Thoughts Survey</u>, and the <u>Attitudes Toward Computers Scale</u>. Because the SISRO learning strategy was expected to affect not only computer anxiety but also self-direction, efficiency, and self-confidence, measures of all these variables were included in order to provide a comprehensive picture of the efficacy and viability of the learning strategy. The use of multiple measures over the four variables was supported by Smith and Glass (1987). They software used (WordPerfect 5.1). The extra credit exercise was given in the same computer laboratories that the members of both groups normally used. The procedures and components used in the extra credit exercise for Experiment Two were identical to Experiment One with one important difference. Due to Experiment Two population's on-going course exposure to software, the word-processing software used in the extra credit exercise was previously unknown to any of the members to the two groups. The specific software package used was Bank Street Writer III. This change also allowed for a stronger measure of transferability of the SISRO learning strategy.

Before the computer exercise actually began, each student took a short (1 minute) typing test to record the number of words per minute each student could type (Appendix C). At the end of the typing test, the results were recorded (Appendix G). Additionally, the student's self-reported previous computer experience was found by orally asking three questions which determined if they indeed had previous computer experience. The results were summarized and recorded as Yes or No (Appendix G). After completing the typing test, the students began the computer exercise (Appendix F).

Part I of the exercise required members from both groups to use Bank Street Writer III to type a short paragraph, save it, and print it. Both groups' time to complete part I, as well as the number of clarifying questions asked of the author, were recorded. Although part I did not have a time limit, it was expected completion would be 10 minutes. Part I's structure was designed to measure the efficiency and the self-direction of the learning strategies used by the students.

Part II required the student to use Bank Street Writer III again to retrieve the short paragraph previously saved in part I, edit it, and then print the updated document. Unlike part I, this section was timed. The student was encouraged, through oral instructions, to complete Part II in 10 minutes. Further, asking questions was discouraged, again through oral instructions, unless the student felt strongly he/she could not proceed. However, Bank Street Writer III reference materials were available for student use. These changed rules allowed the self-directed thinking of the student, drawn from the SISRO learning strategy, to be measured.

Administration of the STAI took place within 1 week after of the completion of the two-part exercise. During the midterm administration of the STAI, the students from both groups who took the extra credit exercise were given extra oral instructions to help them recall the feelings they had while they worked on the exercise. Further, at the end of the term, the STAI was again administered to the Traditional learning strategy group and SISRO learning strategy group.

The percentages of each group who attempted the exercise, typing speeds, previous computer experience, time elapsed, and number of clarifying questions asked during the two parts of the exercise and the three STAI STATE (S) means scores measured over the term of the Traditional learning strategy group and SISRO learning strategy group were compared to determine the efficacy of the learning strategy.

To measure changes in student preferences for future computer courses, inclination to learn to use software packages independently, and attribution of success by students who took the extra credit exercise, a postcourse survey (Appendix H) was given at the same time as the final administration of the STAI.

The Traditional learning strategy group and SISRO learning strategy group differences were measured to find what attributed to their exercise success, changes in their likelihood of taking future specified and unspecified computer courses, and independently attempting to learn specified and unspecified software packages. By correlating these findings with their STAI scores, a clearer picture was available to judge the efficacy of the SISRO learning strategy.

CHAPTER 4
RESULTS

A total of 22 statistical measures were conducted over the variables, anxiety, self-direction, efficiency, and self-confidence, in Experiments One and Two. Three of the 8 measures in Experiment One yielded statistically significant differences in group means, and 4 of the 14 measures in Experiment Two yielded statistically significant differences in group means. What follows is a description of the specific results of each of the measures used and tables of data for those measures which yielded significant differences.

Experiment One

Anxiety

The STATE S scores from the STAI given during the third week of the term, one week after the extra credit exercise, and at the end of the term were compared across the term and between the SISRO and Traditional learning strategy groups. A repeated-measures ANOVA was performed on the S scores for these two groups with group status and participation in the extra credit exercise as the between-subjects factors and time as the within-subjects factor. There was no significant effect of either group status, $F(1,91) = .49$, $p = .487$, or participation in the extra credit exercise, $F(1,91) = .53$, $p = .469$ on S scores. The time effect was also not significant, $F(2,182) = .98$, $p = .378$. See Table 1 for the data used.

Table 1

STAI S Scores over the Term

	Mean	Std Dev	N	
SISRO	40.09	(12.74)	85	Beginning
Traditional	38.69	(11.23)	67	Beginning
Control	37.58	(10.34)	73	Beginning
SISRO	37.71	(12.00)	85	Mid-Term
Traditional	37.84	(11.34)	51	Mid-Term
SISRO	38.97	(13.14)	78	End-Term
Traditional	38.95	(12.66)	57	End-Term
Control	39.02	(12.75)	46	End-Term

Self-Direction

No restrictions on the number of questions asked, part I. A t-test showed a significant difference between group means for the number of questions asked in Part I of the computer exercise, $t(52) = 2.89$, $p < .05$. Specifically, the SISRO learning strategy group asked fewer questions than the

Traditional learning strategy group in order to complete part I of the exercise. See Table 2 for the data used.

Table 2

No Restrictions on the Number of Questions Asked, Part I

	Mean	Std Dev	N
SISRO	1.06	(.96)	36
Traditional	1.94	(1.26)	18

Restrictions on the number of questions asked, part II. In Part II of the exercise, when students were asked not to ask questions unless absolutely necessary, a *t*-test showed no significant difference between group means, $t(52) = 1.05$, $p = .298$. See Table 3 for the data used.

Table 3

Restrictions on the Number of Questions Asked, Part II

	Mean	Std Dev	N
SISRO	1.14	(.99)	36
Traditional	1.44	(1.04)	18

Efficiency

No restrictions on the amount of time used to complete part I. A *t*-test statistic showed no significant difference between group means in the amount of time needed to complete Part I of the computer exercise, $t(52) = -1.83$, $p = .073$. See Table 4 for the data used.

Table 4

No Restrictions on the Amount of Time Used to Complete, Part I

	Mean	Std Dev	N
SISRO	15.44	(5.69)	36
Traditional	12.83	(2.83)	18

Restrictions on the amount of time used to complete, part II. A *t*-test showed a significant difference between group means in the amount of time used to complete Part II of the computer exercise, $t(52) = -3.16$, $p < .05$. Specifically, the SISRO learning strategy group used more time to complete part II of the exercise than the traditional learning strategy group. See Table 5 for the data used.

Table 5

Restrictions on the Amount of Time Used to Complete, Part II

	Mean	Std Dev	N
SISRO	18.14	(6.15)	36
Traditional	13.00	(4.38)	18

Self-Confidence

The extra credit exercise. Comparing the technical ability of the members of both treatment groups who showed up to do the extra credit exercise as measured by the typing speed and the previous computer experience of the members of the groups yielded significant results.

The typing ability of the Traditional learning strategy group was greater than the SISRO learning strategy group, although at the .05 level of statistical confidence it was not. The amount of previous computer experience of the Traditional learning strategy group was statistically greater than the SISRO learning strategy group.

Finally, the percentage of each treatment group who showed up to do the extra credit exercise, as measured by comparing the number of students who completed the beginning term and/or midterm administration of the STAI to the number of those who showed up from each group to do the exercise, was statistically equal. What follows is a description of results of the three self-confidence computer exercise and the statistical measures used.

Typing speed of group members attempting the extra credit exercise. While the difference in typing speed between the group means was approximately 5 words per minute in the traditional group versus the SISRO group, a *t*-test showed no significant difference between group means, $t(52) = 1.63$, $p = .109$. Specifically, the Traditional learning strategy group were faster typists but not statistically greater at the .05 level of confidence. See Table 6 for the data used.

Table 6

Typing Speed of Group Members Attempting the Extra Credit Exercise

	Mean	Std Dev	N
SISRO	20.31	(10.03)	36
Traditional	25.22	(11.29)	18

Previous computer experience of group members attempting the extra credit exercise. A chi-square statistic showed significant differences in the previous computer experience of the students from each group who participated in the exercise, $X^2 = 6.75$, $p < .05$.

Specifically, 36% of the SISRO learning strategy group who volunteered to do the exercise had previous computer experience compared to 78% of the Traditional learning strategy group.

Percent of group members attempting the extra credit exercise. A chi-square statistic showed no significant difference between group means in the proportion of students from each group who volunteered to participate in the extra credit exercise, $X^2 = .443$, $p < .506$. The traditional learning strategy groups' proportion was 30%, and the SISRO learning strategy groups proportion was 36%.

Experiment Two

Anxiety

A repeated-measures ANOVA was performed on the STAI S scores collected during the third week of the term, one week after the extra credit exercise was conducted, and at the end of the term. In this analysis, group status was a between-subjects factor, while time was a within-subjects factor. No significant effect of group status was found, $F(1,41) = .16$, $p = .689$.

However, there was a significant effect of time on the S scores, $F(2,82) = 3.71$, $p < .05$. Specifically, the S scores significantly decreased over time as measured from the beginning of the course to the end of the course for both groups. See Table 7 for the data used.

Table 7

S Scores over the Term

	Beginning	Mid-Term	End-Term	
SISRO	36.86	34.54	31.82	Mean
	(11.12)	(10.18)	(9.12)	Std Dev
	51	35	33	N
Traditional	36.67	34.14	32.32	Mean
	(12.20)	(12.52)	(9.62)	Std Dev
	55	34	19	N

Self-Direction

No restrictions on the number of questions asked, Part I. A t-test showed a significant difference between group means in the mean number of questions asked by each group during Part I, $t(74) = -5.61$, $p < .05$. Specifically, the SISRO learning strategy group asked fewer questions than the Traditional learning strategy group in order to complete part I of the exercise. See Table 8 for the data used.

Restrictions on the number of questions asked, Part II. A t-test statistic showed a significant difference between group means in the mean number of questions asked by each group during Part I, $t(73) = -7.45$, $p < .05$. Specifically, the SISRO learning strategy group asked fewer questions than the traditional learning strategy group in order to complete part II of the exercise. See Table 9 for the data used.

Table 8

No Restrictions on the Number of Questions Asked, Part I

	Mean	Std Dev	N
SISRO	1.03	(1.11)	34
Traditional	3.02	(1.81)	42

Table 9

Restrictions on the Number of Questions Asked, Part I

	Mean	Std Dev	N
SISRO	.21	(.41)	34
Traditional	1.26	(.74)	42

Efficiency

No restrictions on the amount of time used to complete, Part I. A t-test showed a significant difference between group means in the amount of time needed to complete Part I of the computer exercise, $t(74) = -4.70$, $p < .05$. Specifically, the SISRO learning strategy group used less time than the traditional learning strategy group to complete part I of the exercise. See Table 10 for the data used.

Table 10

No Restrictions on the Amount of Time Used to Complete, Part I

	Mean	Std Dev	N
SISRO	14.15	(5.15)	34
Traditional	20.26	(6.00)	42

Restrictions on the amount of time used to complete, Part II. A *t*-test showed a significant difference between group means in the amount of time needed to complete Part II of the computer exercise, $t(73) = -5.50$, $p < .05$. Specifically, the SISRO learning strategy group used less time to complete part II of the exercise than the traditional learning strategy group. See Table 11 for the data used.

Table 11

Restrictions on the Amount of Time Used to Complete, Part II

	Mean	Std Dev	N
SISRO	10.00	(2.37)	34
Traditional	14.95	(4.78)	41

Self-Confidence

Presurvey and postsurvey comparisons. Four questions measuring self-confidence were included in the survey given to the students at the beginning and again at the end of the term. What follows is a description of results of those comparisons and the statistical measures used.

> SURVEY QUESTION: "How likely are you to take any of the following courses or workshops in the next two years?"

A total of 11 types of courses were provided as choices; see Appendix H for the specific types of courses listed. Each type of course had four possible indicators for the likelihood of choosing the course, ranging from "Not Likely" through "Very Likely." Using a Likert-type, 4-point scoring system, a composite score was calculated ranging from a possible low score of 11 to a maximum score of 44.

A repeated-measures ANOVA showed no significant effects of group status (for those who completed the course) on the number and likelihood of taking computer courses in the future, $F(1,46) = .64$, $p = .429$. However, there was a significant effect of time on the number and likelihood of the courses chosen, $F(1,46) = 8.46$, $p < .05$. Specifically, both groups chose fewer courses and indicated less likelihood of taking courses at the end of the term than at the beginning of the course. See Table 12 for the data used.

Table 12

Number and Likelihood of Courses Chosen Over Time

	Beginning	End	
SISRO	25.43	22.50	Mean
	(7.35)	(6.78)	Std Dev
	30	30	N
Traditional	23.78	21.28	Mean
	(5.69)	(6.92)	Std Dev
	18	18	N

SURVEY QUESTION: "How likely are you, ON YOUR OWN, to attempt to learn to use the following types of software in the next two years?"

A total of 11 types of software were provided for choices; see Appendix H for the specific types of courses listed. Each type of software had four possible indicators for the likelihood of choosing the course ranging from "Not Likely" through "Very Likely." Using a Likert-type, 4-point scoring system, a composite score was calculated ranging from a possible low score of 11 to a maximum score of 44. A repeated-measures ANOVA showed no significant effects over time, $F(1,47) = .05$, $p = .87$, or group membership, $F(1,47) = .13$, $p = .721$, in the number and likelihood of software packages to be attempted independently.

SURVEY QUESTION: "After taking this course, I expect future courses or workshops will be"

<> FUN
<> EASY
<> INTERESTING
<> CHALLENGING
<> DIFFICULT
<> STRESSFUL

A 6-point scale ranging from 1 for "FUN" to 6 for "STRESSFUL" was used for measuring the students choices. A repeated-measures ANOVA showed no significant effect of group status, $F(1,48) = 1.09$, $p = .302$. Specifically, there was no change between group means in students' beliefs about the difficulty level of future unspecified computer courses. However, there was a significant effect of time, $F(1,48) = 4.46$, $p < .05$. Specifically, both groups' beliefs about the difficulty level of future computer courses showed a significant shift toward the belief that future courses would be easier. See Table 13 for the data used.

SURVEY QUESTION: "Imagine that it is six months from now. You are given an unknown software package to use. How confident are you that ON YOUR OWN you would be able to figure out how to use it?"

A 6-point scale ranging from 1 for "Very Confident" to 6 for "Very Unconfident" was used for measuring the students choices. A t-test showed no significant difference between group means, $t(51) = .13$, $p = .894$. Specifically, the groups' self-reported confidence level of ability to learn to use an unknown piece of software independently were not the statistically different. The SISRO learning strategy group mean was 2.24 and the Traditional learning strategy group mean was 2.20.

Table 13

Change in Expectations about Future Courses Taken Over the Term

	Beginning	End	
SISRO	3.55	3.03	Mean
	(1.12)	(.75)	Std Dev
	31	31	N
Traditional	3.16	2.95	Mean
	(1.21)	(.78)	Std Dev
	19	19	N

The extra credit exercise. The technical ability of the members of both treatment groups who participated in the extra credit exercise, as measured by typing speed and previous computer experience, was statistically equivalent. Further, the percentage of each treatment group who showed up to do the extra credit exercise, as measured by comparing the number of students who completed the beginning term and midterm administration of the STAI to the number of those who showed up for each group to do the exercise was statistically comparable.

Additionally, included in the postsurvey were two questions for those who did the extra credit exercise. These two questions asked the students to self-report what skills they used to do the exercise; see Appendix H for the specific skills choices from which the students could choose. There were no significant differences in their choices. What follows are the specific statistics used and the results for the five measures of self-confidence.

Typing speed of group members attempting the extra credit exercise. A t-test showed no significant difference between group means in the typing speed of those who volunteered to do the computer exercise, $t(74) = 1.26$, $p = .212$. See Table 14 for the data used.

Table 14

Typing Speed of Group Members Attempting the Extra Credit Exercise

	Mean	Std Dev	N
SISRO	32.44	(15.26)	34
Traditional	28.46	(14.70)	41

Previous Computer Experience of Group Members Attempting the Extra Credit Exercise. A chi-square statistic showed no significant difference between group means, $X^2 = 0$, $p = 1.000$. Specifically, 32% of the SISRO learning strategy group who showed up to do the exercise had previous computer experience compared to those 33% of the Traditional learning strategy group.

Percent of Group Members Attempting the Extra Credit Exercise. A chi-square statistic showed no significant difference between group means in the proportion of students from each group who volunteered to participate in the extra credit exercise, $X^2 = .077$, $p = .782$. Specifically, 91% of SISRO learning strategy group and 84% of Traditional learning strategy group attempted the extra credit computer exercise.

Postsurvey Computer Exercise Questions.

"What was the MOST [or LEAST] used skill or action you used to do the exercise"

1. Asking the monitoring teacher specific questions.
2. Looking through the reference manual.
3. Previous word-processing experience.
4. Previous computer software experience.
5. Skills I learned in my present computer course.
6. Previously acquired general organizing skills.
7. Other ______________________________.

A chi-square statistic showed no systematic differences between the groups in the choices they said facilitated their completion of the exercise, $X^2(6) = 4.807$, $p = .569$. However, an examination of the differences of the choices showed that "Looking through the reference manual" by both groups was the least used skill, while "Skills I learned in the present computer course" was the most used skill by both groups.

Table 15

Summary of the Results

Variables	Experiment One	Experiment Two
Anxiety: Stai S Scores	NS	NS
Self-direction: Number of questions asked to complete exercise, Part I	*	*
Self-direction: Number of questions asked to complete exercise, Part II	NS	*
Efficiency: Time used to complete exercise, Part I	NS	*
Efficiency: Time used to complete exercise, Part II	*	*
Self-confidence:		
Likely to take specific course(s) in the future	--	NS
Likely to learn specific software on your own in the future	--	NS
Expect unspecified future courses to be: Fun . . . Stressful	--	NS
How confident are you to learn unknown software on your own in the near future: Very confident . . . Very unconfident	--	NS
Previous computer experience of each group who attempted exercise	*	NS
Typing speed of each group who attempted exercise	NS	NS
Percent of each group attempting exercise	NS	NS
Most useful skill to do computer exercise	--	NS
Least useful skill to do computer exercise	--	NS

* Significant differences between group means.
NS No significant differences between group means.
-- Not measured.

CHAPTER 5
DISCUSSION

The SISRO learning strategy was developed to fill two basic needs for teachers of computer software. The first need was to provide teachers with a process of presenting unknown software to students in a timely and nonstressful manner. The second need was to provide students with a learning strategy from which they could, on their own, learn to use unknown software packages in the future. To make sure the SISRO learning strategy was meeting these needs, it would have to be tested in a variety of educational settings.

Additionally, testing the SISRO learning strategy for its ability to reduce computer anxiety, increase self-direction, reduce learning time, and increase self-confidence in different settings would provide clear and comprehensive measures of the SISRO learning strategy's efficacy.

Experiment One was designed to test the efficacy of the SISRO learning strategy as an isolated curriculum component in a freshman orientation college course setting. Since it was just one curriculum component among many other college survival techniques and skills taught, the SISRO learning strategy was not reinforced by the other parts of the curriculum. Therefore, this educational setting would serve as an example of a minimally organized structure in which learning how to use software could be presented.

Experiment Two was designed to test the efficacy of the SISRO learning strategy as the dominant software presentation process in an introduction to computers college course setting. Since it was the prevailing presentation procedure throughout the course, it was constantly referenced in the laboratory and lecture settings of the course. This pervasive exposure reinforced the SISRO learning strategy's usefulness across several software applications. Therefore, this educational setting would serve as an example of a maximumly organized structure in which learning how to use software could be presented.

In summary, the two experiments conducted represented minimum and maximum time-exposure boundaries for presenting the SISRO learning strategy in organized educational settings for college courses. What follows is a discussion of each of the four variables (computer anxiety, self-direction, efficiency, and self-confidence, as measured and reported in Chapter 4) for both Experiment One and Experiment Two.

Experiment One

Anxiety

There were no significant differences found between group STAI S scores. This result was not expected. Observed behaviors, both subtle and nonsubtle, as witnessed by the author, belie the midterm STAI S scores. For example, during

Part I of the exercise the Traditional learning strategy group asked significantly more questions than SISRO learning strategy group. Further, the Traditional learning strategy group was visibly more nervous than the SISRO learning strategy group throughout the extra credit exercise. What could have contributed to this inconsistency in the recorded S scores was the timing of the administration of the STAI at the midterm. Due to time constraints on the use of the 16-station microcomputer laboratory, the STAI could not be administered immediately before or immediately after the extra credit exercise. The midterm administration of the STAI was 4 to 7 days after the extra credit exercise, depending upon the scheduled meeting times of the course sections. Oral instructions were given to both groups to help them remember their feelings at the time of the exercise. However, the time delay of up to 7 days suggests too much history had occurred for the members of both groups who attended the extra credit exercise session to recall accurately their feelings.

There are several possible design and administration solutions to the problem situation which caused a lack of significant differences found for future researchers to explore. Future use of the STAI to measure computer anxiety demands immediate administration after or before performances of computer competencies are measured. This would require adequate time being set aside at the time of the test for administration of the STAI. An alternate solution would be to use another instrument to measure anxiety which specifically addresses computer anxiety and is not so sensitive to history. Another possible solution would be to administer the STAI more frequently, perhaps 7 to 9 times during the course term versus the three administrations conducted during this experiment. Therefore, the residual anxiety effects of the exercise test could be more accurately extrapolated across the time of the test in the middle of the term, if necessary.

Self-Direction

Self-direction measurement, defined as the number of questions asked in a free environment and in a restrained environment, produced mixed results. In the free environment, where questions were freely asked and freely answered, the SISRO learning strategy group asked significantly less questions than the Traditional learning strategy group. However, in the restrained environment where asking questions was discouraged, there was no significant difference in the number of questions asked between both groups.

These varying inconsistent results indicate that the self-directing character of the SISRO learning strategy group seemed to be somewhat fostered by their use of the SISRO learning strategy. Specifically, the meta-cognitive nature of the SISRO learning strategy allowed the SISRO learning strategy group to recall the process of using the word-processing package and then apply it at the beginning of the exercise. It seems, however, that the Traditional learning strategy group adapted quickly to the exercise design, and during Part II of the exercise asked no more questions to complete the computer exercise than the SISRO learning strategy group. The self-reported previous computer experience level of members of the Traditional learning strategy group who attempted the exercise suggests that they were able to recover from the initial impact of the test design because they were significantly more experienced with computer software than the members of the SISRO learning strategy group who attempted the exercise.

It seems the SISRO learning strategy can close the self-direction gap between students with previous exposure to computer software and those who have limited exposure to computer software but who utilize the SISRO learning strategy, even if the exposure to it is limited.

Efficiency

Efficiency testing, as measured by the amount of time necessary to complete sections of the exercise in a free environment and in a restrained environment, produced mixed results. In the free environment, where questions were freely asked and freely answered, the SISRO learning strategy group and the Traditional learning strategy group used equivalent amounts of time to complete Part I. However, in the restrained environment, where asking questions was discouraged, the Traditional learning strategy group used significantly less time than SISRO learning strategy group to complete Part II.

These mixed results indicate use of the SISRO learning strategy is no more time efficient than using traditional learning strategies. In fact, in this educational setting, the SISRO learning strategy may be even more time costly.

The apparent lack of efficiency of the SISRO learning strategy as compared to Traditional learning strategies can not be attributed to the typing speed differences between the groups. Although the typing speed difference between groups was over five words per minute, it was not statistically significant at the .05 level of confidence.

Perhaps the significant difference in previous computer experience between the groups became a factor in the Part II section of the exercise. The SISRO learning strategy group possessed significantly less experience (36% versus 78%) than the Traditional learning strategy group. Therefore, the 1-hour SISRO presentation was not long enough for the inexperienced students to internalize the strategy. Hartley et al. (1984), Honeyman and White (1987), and Weil (as cited in DeLoughry, 1993) suggest that adults need a considerable number of hours of exposure to computer applications before they are comfortable with this technology. Also, one must remember the anchoring concepts had to be created for the inexperienced students in both groups during their respective teachers' presentations. For the experienced students, the 1-hour presentation either reinforced their previous procedures or they quickly subsumed the learning strategy taught into their previously known one. The members of the SISRO learning strategy group were able to hold their own, time wise, compared to the Traditional learning strategy group in Part I of the exercise. But the use of the SISRO strategy did not seem to help the SISRO learning strategy group overcome their relative inexperience compared to the time needed by the Traditional learning strategy group to complete Part II of the exercise.

The efficiency results call into question the ability of the SISRO learning strategy, like other software learning strategies, to be taught in a limited time exposure educational setting. Future research should perhaps explore the minimal time exposures necessary for presenting known successful software learning strategies that would promote efficient and self-directing software learning among adults.

Self-Confidence

The self-confidence level was not measured with a single direct instrument. The change in self-confidence level was assessed by reviewing three sets of measures. Specifically, they were the percentages of students from both groups with previous computer experience who participated in the computer exercise, the typing ability of the students who attempted the extra credit computer exercise, and the percentage from each group who attempted the exercise.

Comparison of the three self-confidence level measures chosen for both groups showed significant differences only in the measure of percentages from each group with previous computer experience who attempted the extra credit computer exercise. No significant differences were found in the other two self-confidence measures. The significantly higher previous computer experience level of the traditional learning strategy group members who attempted the exercise suggests a higher level of self-confidence among members of the SISRO learning strategy group. It seems the SISRO learning strategy was sufficiently understandable to the 64% of the SISRO learning strategy group who attempted the exercise and possessed little or no previous computer software experience. While only 22% of the Traditional learning group who attempted the exercise had little or no previous computer software experience, they apparently felt enough self-confidence from their 1-hour presentation. The author maintains that the explanation of the differences in percentages between the groups is based on the notion that students show their self-confidence in their skills by their willingness only to participate in activities where they have a reasonable chance of success. This belief is supported by Cross (1982) who stated,

> The general hypothesis about the relationship of self-evaluation . . . to educational participation is that those with self-confidence in their learning abilities will avoid the risk required in learning new things, basically because they do not expect to succeed. In their [adults] experience with education in the past, the outcome of the effort is more likely to be pain or failure than the reward of a new job, a promotion, the admiration of others, or the self-satisfaction of succeeding at the learning task. (p. 133)

The results of the comparisons involving the percentage of participants with previous computer measure did give some support to the idea that use of the SISRO learning strategy bolsters self-confidence in adults attempting to learn software better using traditional learning strategies. However, when the three measures are viewed as a group, these measures indicate very limited support for the idea that self-confidence is increased by use of the SISRO learning strategy. In conclusion, the SISRO learning strategy seems to be only marginally better than traditional learning strategies in maintaining or increasing adults' current level of self-confidence concerning their attempt to learn computer software.

In summary, the first experiment seems to show the advance organizer-metacognitive learning strategy to be equally as effective as the traditional learning strategy in reducing anxiety, slightly more effective in increasing self-directing capabilities, slightly less effective in increasing efficiency, and slightly more effective in improving self-confidence. Additionally, the results seem to indicate that an educational setting providing only a 1-hour limit on presenting a software learning strategy is not enough time to provide students sufficiently with an advance organizer-metacognitive learning strategy to use a software package independently. Further, the limited exposure time prevents the student from developing sufficient self-confidence in his or her computer literacy capabilities.

Experiment Two

Anxiety

There were no significant differences found between group STAI S scores. This result was not expected. However, observed behaviors, both subtle and nonsubtle, as witnessed by the author, belie the midterm STAI S scores. The Traditional learning strategy group was visibly more nervous than the SISRO learning strategy group throughout the extra credit exercise. Further, the Traditional learning strategy group asked more questions initially and took more time to get started than the SISRO learning strategy group. What could have contributed to this inconsistency in the S scores was the timing of the administration of the STAI at the midterm. Due to time constraints on the use of the microcomputer laboratories, the STAI could not be administered immediately before or immediately after the extra credit exercise. The midterm administration of the STAI was 4 to 7 days after the extra credit exercise, depending upon the scheduled meeting times of the course sections. Oral instructions were given to both groups to help them remember their feelings at the time of the exercise. However, the time delay of up to 7 days suggests too much history had occurred for the members of both groups who attended the extra credit exercise session to recall accurately their feelings.

There are several possible design and administration solutions to the situation which caused a lack of significant differences to be found for future researchers to explore. Future use of the STAI to measure computer anxiety demands immediate administration after or before performances of computer competencies are measured. This would require adequate time being set aside at the time of the test for administration of the STAI. An alternate solution would be to use another instrument to measure anxiety which specifically addresses computer anxiety and is not so sensitive to history. Another possible solution would be to administer the STAI more frequently, perhaps 7 to 9 times during the course term, versus the three administrations conducted during this experiment. Therefore, the residual anxiety effects of the exercise test could be more accurately extrapolated across the time of the test in the middle of the term, if necessary.

An interesting finding of the three administrations of the STAI to both groups was the significantly lower S scores for both groups across the term. This finding perhaps is explained by the nature of the introduction to computers course. Since introduction to computers courses can normally be taken without any prerequisite courses, they are designed to present computer technology in such a manner as to foster a positive and proactive approach among the students in the learning and using of computer hardware and software during the course and after the course is over. Additionally, this type of course seems to be meeting the need of program administrators, as described in Chapter 1, to present computer technology to the general community college student in a way that lets a significant number of completers feel capable of taking additional computer courses. It seems that both Traditional and SISRO learning strategies are equally capable of reducing anxiety levels over a college term.

Self-Direction

Self-direction measurement, defined as the number of questions asked in a free environment and in a restrained environment, produced clear results. In the free environment, where questions were freely asked and freely answered, the SISRO learning strategy group asked significantly less questions than the Traditional learning strategy group. Additionally, in the restrained environment where asking questions was discouraged, the SISRO learning strategy group asked significantly less questions than the Traditional learning strategy group.

These unambiguous results indicate that the self-directing character of the SISRO learning strategy group seemed to be fostered by the use of the SISRO learning strategy, when reinforced over a discrete time frame. Specifically, the advance organizer-metacognitive nature of the SISRO learning strategy seemed to allow the SISRO learning strategy group to recall the process of using the word-processing package and then apply it throughout the exercise with a previously unknown software program. It seems that the SISRO learning strategy does establish an advance organizer-metacognitive approach in the minds of students for independently discovering the basic operations of unknown application computer software.

Efficiency

Efficiency testing, as measured by the amount of time necessary to complete the two sections of the exercise in a free environment and in a restrained environment, produced clear results. In the free environment, where questions were freely asked and freely answered, the SISRO learning strategy group used less time than the Traditional learning strategy group to complete Part I. Additionally, in the restrained environment where asking questions was discouraged, the SISRO learning strategy group used less time than the Traditional learning strategy group to complete Part II.

These clear results indicate use of the SISRO learning strategy is more time efficient than using traditional learning strategies. The apparent efficiency of the SISRO learning strategy, as compared to the Traditional learning strategy, cannot be attributed to the technical competence of SISRO learning strategy group, who attempted the computer exercise, since both groups were found to possess equivalent typing speeds and previous computer experience levels.

It seems the SISRO learning strategy does establish an advance organizer-metacognitive approach in the minds of students for efficiently discovering and utilizing the basic operations of unknown application computer software. However, it seems this clear efficiency comes after a period of time. This again supports Hartley et al. (1984), Honeyman and White (1987) and Weil (as cited in DeLoughry, 1993), who suggested that adults need a number of hours of exposure to computer applications software before they are comfortable with this technology.

Self-Confidence

Self-confidence was not measured with a single direct instrument or variable. Rather, it was assessed by reviewing nine sets of measures. These measures were divided into two areas. The first area was the self-confidence level as expressed in the technical level of expertise of the group members who attempted the exercise. Specifically, these measures were the percentages of students from both groups with previous computer experience who participated in the computer exercise and the typing ability of the students who attempted the extra credit computer exercise. The second area was the self confidence level as expressed in the percentage from each group who attempted the exercise and the self-reported responses on the presurvey and postsurvey. Specifically, these measures were the likelihood of taking specified computer courses, likelihood of learning specified software independently, expectation of difficulty levels of future courses, self-reported confidence levels to independently learn unspecified software, and self-reported most and least useful skills to complete volunteer software exercise. Comparison of the nine self-confidence level measures showed no significant differences between groups. However, several of the measures produced some interesting findings.

It seems that the self-confidence level of both groups was boosted over the term in respect to the need of the group members for future courses and their perceived level of difficulty. Specifically, both groups chose significantly lower numbers of potential courses at the end of the term compared to the beginning of the term. Also the group's perception of future courses' difficulty moved toward the "easy" end of the scale significantly. In short, it seems both groups felt sufficiently confident in their new-found computer literacy to reduce their perceived need for future courses and those taken would cause less strain on their capabilities.

Both groups showed no significant difference in their reported most and least used skills to complete the exercise. However, just as in the second pilot study, they both reported "use of the reference manual" as the least used skill and"skills learned in this class" as the most used skill. This finding suggests students in both groups equally valued the importance of the learning strategies taught to them in their just completed computer course. Finally, use of the SISRO learning strategy is equivalent to the Traditional learning strategies in maintaining or increasing adults' current level of self-confidence concerning their attempt to learn computer software.

In summary, the second experiment found the advance organizer-metacognitive learning strategy to be equally as effective as the traditional learning strategy in reducing anxiety, more effective in increasing self-directing capabilities, more effective in increasing efficiency, and equally as effective in improving self-confidence. Therefore, the results seem to indicate that an educational setting providing at least 15 hours of exposure and practice with an advance organizer-metacognitive learning strategy on applications software does provide a student with an independent and efficient strategy to learn new software which is superior to traditional learning strategies. However, the SISRO learning strategy is only equivalent to other computer software learning strategies in enhancing the self-concept of the user's computer literacy capabilities.

Suggestions for Further Research

This study attempted to help address Mruk's (1987) concern that little research exists on effective teaching strategies for computer software, and Glaser's (1988) call for a more precise focus on subject-specific means for competent performance in research. He hoped those types of studies would lead to "significant breakthroughs in instruction" (p. 25). Therefore, the structural limitations of the study should not be viewed as limiting the generalizability of the SISRO learning strategy, but, rather, this study should be viewed as just among the first of many research studies into the software learning strategy area. Inclusion of other factors with the one or more factors of this study in future studies should prove a rich ground of discovery for researchers.

What follows are several factors which should be included in future research:

1. It is imperative that special efforts be made to include adult members from lower social economic sectors of our society in training programs for computer software. This country no longer has a large pool of high wage, low skill jobs. Research should be conducted to find self-directing software learning paradigms especially for adult members of lower social economic status. This effort may help defuse a

potentially larger social problem of a significant segment of adults being underemployed or unemployed permanently due to their technological illiteracy.

2. Productivity is the key to any business staying competitive. Constant changes in computer applications software in the workplace can be taken as a given. Therefore, studies should be conducted to study means of moving adults from trainees to productive users of computer applications as quickly and efficiently as possible.

3. Computer anxiety levels of the groups from both experiments proved to be only minimally affected by the use of the SISRO Learning Strategy. Continued efforts should be undertaken to discover means of reducing computer anxiety during the teaching computer applications software process. As an example, studies of anxiety levels for adult users of game software, which is usually thought of as a risk-free enterprise, would yield interesting findings when compared with the anxiety levels some adults attach to learning applications software.

4. While the maximum and minimum time exposure settings were the defining differences in the two experiments of this study, other, less drastic differences in time exposures should be set in similar future studies conducted to help interpolate the findings of this study.

In summary, inclusion of any of these four factors with the present study in future research should help prove the viability of the SISRO Learning Strategy.

<u>Conclusion</u>

The results from the two experiments indicated that the advance organizer-metacognitive learning strategy was somewhat more effective in improving the performance measures of self-direction and time efficiency of the students learning new applications software than traditional learning strategies. In particular, the performance value of the SISRO learning strategy was clearly demonstrated in Experiment Two where the time exposure was maximized. In Experiment One, where the exposure to the SISRO learning strategy was minimal (1 hour of instruction), the performance measures of the SISRO learning strategy group compared to Traditional learning strategy group were mixed. Clearly, the more exposure and practice one has with advance organizer-metacognitive strategies, the better the results. This study seems to support Jerrold's (1985) contention that conscious use and continued practice with an advance organizer as a learning strategy improves the students's performance efficacy.

A comparison of the results of self-concept measures of computer anxiety and self-confidence of the two experiments showed that the use of the SISRO learning strategy is only marginally more effective in improving the students' self-concept of their capabilities to learn software than traditional learning strategies. Interestingly, the minimal exposure setting of Experiment One showed what little differences there were between the SISRO learning strategy group and traditional learning strategy group in the self-concept domain. Specifically, it seems the SISRO learning strategy gave more of an initial boost to a student's self-concept in the Experiment One's 1-hour exposure setting than in Experiment Two's multiple hour exposure setting. More to the point, however, it seems this study supports the idea that computer anxiety is reduced over time (Cambra & Cook, 1984; Honeyman & White, 1987; Rosen & Weil, as cited in DeLoughry, 1993) with the finding of significantly reduced STAI S scores, self-reported lower expectation of need for fewer future classes, and self-reported higher self-confidence about difficulty levels of future courses for both groups in Experiment Two as measured across the term.

Some believe the need for effective software learning strategies will soon become moot because of newer and more user-friendly graphical user interfaces (GUIs). Bunderson (1987) said, "Standard and easy man-machine conventions are opening the world of computers to people who have mistrusted and avoided computers" (p. 304). However, the predictions that computer anxiety, and all its debilitating effects, will be reduced with newer interfaces is not accepted by all. Jackson (1987) said,

> Although the problem of computer phobia may *age out* as people who were reared with computers enter the labor force, the promise of newer, more exotic technologies may make today's computer hacker tomorrow's technophobic. (p. 254, emphasis in original)

While Rubens (1987) and Flynn (1993) state today's workers find the new generation of interfaces easier to learn and easier to use, Rosen and Weil (as cited in DeLoughry, 1993) suggest otherwise. Rosen has been quoted as saying,

> The prevailing attitude, "Just keep flooding the world with technology and it [technophobia] will go away" is wrong. We've been doing this for nine years and in nine years I haven't seen any sort of decrement. (p. 28)

It is also important to note that while computer use continues to increase outside the home, computer use in the home is still not a dominant activity. Flynn (1993), citing research from Link Resources, found that 70% of the 96.3 million U.S. households still do not have a computer in their homes. Sparks (1986) found the single greatest indicator of successful computer literacy among students was the presence of a computer at home. As more computers move into homes, there will be an increasing need for independent learning strategies. Clearly, researchers must continue to look for nonstressful, self-directing, efficient, and confidence-building learning strategies to introduce software to computer users. The SISRO learning strategy was developed and tested to search for a standard interface paradigm that could be used across many software products and platforms now and in the future. Only by further testing of the SISRO learning strategy, along with other software learning strategies, in a variety of educational settings, with different populations, and with a large number of software products can researchers hope to gain sufficient knowledge to create viable and generalizable software learning strategies that may stand the test of time.

APPENDIX A
SISRO TEACHER PRESENTATION OUTLINE

INPUT--PROCESSING--OUTPUT is basic way humans, computer hardware and computer software are constructed to solve problems.

I) HUMAN:

- i) INPUT--"What is 6 times 4?" (received by ears and eyes)
- ii) PROCESSING--Find appropriate program to solve problem from previous education and experience. (brain)
- iii) OUTPUT--"24" (voice)

  Problem: Humans are slow solving problems, make mistakes and psychologically do not like repetition.

II) HARDWARE:

- i) INPUT--Keyboard (used most often)
- ii) PROCESS--CPU (designed to accept programs and data, make comparisons and do arithmetic functions.
- iii) OUTPUT--Screen and/or printer (people still need paper copy)

  Advantage: All computers are generalized machines. Change software to solve different problem.

III) SOFTWARE:

- i) INPUT--Placement of data into program
- ii) PROCESSING--Place appropriate program into memory of computer.
- iii) OUTPUT--As the result of program's functions, information is generated and sent to an output device.

  Concern: To use a software program, you must have a basic idea what that software will do. Example: Word processing for creation of documents, a database program for making labels, or scientific software to gather measurements.

INSTRUCTOR HINT: Keep emphasizing I-P-O in software and loop back with your references.

Description and Rationale
From the I-P-O discussion comes the following 5 basic operation questions that must be answered to effortlessly, quickly and
efficiently use a new software program.

INSTRUCTOR HINT: REPEAT THIS!

Concern: To use a software program, you must have a basic idea what that software will do. Example: Word processing for creation of documents, a database program for making labels, scientific software to gather measurements, etc.

1) What is the **S**tartup procedure?
   a) Know the product you want.
   b) Discover what "local" computer environment steps that must be taken to get computer to the point where the needed program can be loaded.
   c) Discover what particular steps are necessary to get to data entry point of the software program. Usually, a main menu or blank data entry screen.

2) What is the **I**nput procedure?
   a) Remember goal of the program.
   b) If no input structure is needed, for example, word processing, just start entry of data.
   c) If input data structure must be created, for example, data base programs, create input structure and then enter data.

3) What is the **S**ave procedure? (One of the following scenarios will apply.)
   a) Save and Continue: Do this to keep interruption of power from causing data entered from being lost.
   b) Save and Begin New: Do this when you wish to stop working on one project and begin a another project which requires the same software program. For example, You wish to stop working on one letter to one person and you wish to work on letter to different person.
   c) Save and Quit the Program: Do this when you wish to stop working on one project and to quit for the day or start another type of program.

Note: All the above scenarios make it possible for a user to edit a data file in the future, a fundamental reason for using computers in the first place!

4) What is the **R**etrieve procedure?

   a) Depending on where you are in a program, at the DOS prompt or at a system interface will determine how much of the START-UP procedure you will have to do.

   b) Once you get to the main data entry point of the program, you will then look for the steps necessary to recall the data file you wish to utilize.

   Caution! If you are still in a program and wish to work with another data file, it is suggested that you be sure to clear the current data file from the program. Look at "How do you save a file? Scenario b", for clarification.

5) What is the **O**utput procedure?

   a) Since the normal output will be to a printer, you should check to make sure the hardware (computer and printer), are physically connected and ready to work.

   b) Some software packages require that you specify what type of printer you plan to use. Usually it is a one shot deal for the local environment in which the software is being used.

INSTRUCTOR HINT: Be sure to review these steps conceptually before going to the practical exercise. Additionally, remember to emphasize that these 5 steps (SISRO) apply to ALMOST ALL software and hardware situations and should serve as a guide for independent discovery of how to use unknown software.

Suggested Class Exercise using WordPerfect for DOS

INSTRUCTOR HINT: Now that you have explained the theory (I-P-O) and the SISRO learning strategy, you should have the student's walk through the strategy with the following example. Remember to caution the students not to try to anticipate your next commands, but to look at this exercise for future understanding of an unknown software packages.

"Class, we are now going to do a exercise that will show you how to use the 5 basic questions, also known as the SISRO strategy."

1) Start-Up Procedure:
   a) Hardware steps
   b) Software steps
   c) Should be at main blue screen of WP
      i) Press xxx.
      ii) Press backspace to erase xxx.
      iii) To get rid of something you must put cursor to the right of it.

2) Input Procedure:
   Type "Dear Mom" then ENTER key once.
   Press the ENTER key three times.
   Finish the following sentence, "I am taking this course because . . . " type at least two lines. Do not press the ENTER key. You can type more than two lines if you wish.
   Notice the word wrap.
   WALK AROUND TO MAKE SURE ALL STUDENTS ARE WORKING!
   GIVE THEM ABOUT TWO OR THREE MINUTES.
   Now press the ENTER key three times.
   Type "Sincerely," and press ENTER key three times
   Type "Your Name" and then press the ENTER key once.

3) Save Procedure:
   Remember there are three Save Scenarios,
   a) Save and Continue
   b) Save and Start New
   c) Save and Exit

   We are going to use c)
   Make sure to use A:LETTER
   Since we now be at the W: PROMPT!

INSTRUCTOR HINT: Keep reminding the class where they are in the process.

4) Retrieve Procedure:

a) Minimal use of startup procedure since we are at W: PROMPT!
b) Use F5, but watch out for use of 6 when 1 should be it.

INSTRUCTOR HINT: Class could press # and ENTER key. WATCH OUT!

c) Document should soon appear on the screen.

5) Output Procedure:

INSTRUCTOR HINT: If you are running behind on time just have 4 students do the following and let the rest watch.

a) Follow the PRINT steps
Look to see if Select Printer has a printer type is showing. If it isn't you must go into the Select Printer Menu. BE CAREFUL!
b) Press 1 to print the full document.

INSTRUCTOR HINT: Be patient. It will take a minute to print.

Final step: Shut down computer physically. Leave disks next to computers.

FINAL INSTRUCTOR PROCEDURES:

REVIEW WHAT YOU JUST HAVE DONE!

RECALL THE 5 STEPS AND HOW THEY CAN BE USED BY THE FUTURE.

MENTION THAT THIS ONE SESSION DOESN'T TAKE THE PLACE OF A COLLEGE CREDIT WORD-PROCESSING CLASS OR A COMMUNITY EDUCATION WORD-PROCESSING CLASS.

APPENDIX B
SISRO STUDENT NOTES FOR WORDPERFECT 5.1 (DOS)

VERSION: WordPerfect 5.1 Name:________________

NOTE: The following instructions assume that WordPerfect is stored on the hard drive (usually drive C:)

I. What is the START-UP procedure?

1) Turn on the monitor, printer and then the computer.
2) After about a minute C:\> OR C> should appear on the screen.
3) If you are using a datadisk, put it in the appropriate drive now. (Example: If your system has a hard drive and one floppy drive, you will be placing your datadisk in the A drive.)
4) Type WP and press the ENTER key.
5) If the message "Are other copies of WP currently running (Y/N)?" appears on the screen, press N .
6) A blank screen should now appear with a status line in the lower right corner of the screen.

NOTES:____

II. What is the INPUT procedure?

1) Be sure you have a blank screen.
2) Type your document.

NOTES:____

III. What is the SAVE procedure?

A) [**Save and Continue Scenario**]

1) Press F10.
2) Make sure the drive and/or directory shown in the lower left corner is correct, if not change it.
3) Press the ENTER key. (This will save the document and return you to the document for further work.)

B) [**Save and Start Another Document Scenario**]

1) Press F7.
2) When the screen asks SAVE DOCUMENT (Y/N)? press Y.
3) When the screen asks DOCUMENT TO BE SAVED?, type in the name of the document. If you are saving the file on a different directory and/or drive be sure to type that information first.
(Example: You wish to save the document TEACHER on the A drive. You would type A:TEACHER.WPF)
4) Press the ENTER key.
5) If the screen asks REPLACE? type Y.
6) When the screen asks EXIT WP?,
type N to CLEAR THE SCREEN and begin work on another document.

C) [**Save and Exit Scenario**]

1) Press F7.
2) When the screen asks SAVE DOCUMENT (Y/N)? press Y.
3) When the screen asks DOCUMENT TO BE SAVED?, type in the name of the document. If you are saving the file on a different directory and/or drive be sure to type that information first.
(Example: You wish to save the document TEACHER on the A drive. You would type A:TEACHER.WPF)
4) Press the ENTER key.
5) If the screen asks REPLACE? type Y.
6) When the screen asks EXIT WP?,
type Y if you want to return to DOS Prompt.

NOTES:____

IV. What is the RETRIEVE procedure?

1) Do the START-UP procedure or make sure you don't have another document showing.
2) Press F5.
3) If the document is on the same drive and/or directory shown in the lower left corner of the screen go to step 4,
OR
if the name of the drive and/or directory where your document is located is different from the one shown in the lower left corner of the screen; type the name of the drive and/or directory and a colon (:), then go to step 4.
(Example: If the document TEACHER is located on the A drive and you are in the C drive, type A: .)
4) Press the ENTER key.
5) Move the cursor down until the bold line covers the title you want.
5) Press 1.

V. What is the OUTPUT procedure?

1) Be sure the printer is turned on and has plenty of paper available.
2) Press SHIFT and F7
3) Press number matching your selection from MENU. (Usually 1 is pressed.)

NOTES:____

VI. How do you EXIT from WordPerfect?

1) Go to the SAVE procedure and follow the Save and Exit Scenario.

NOTES:____

APPENDIX C
SELF-REPORTING 1-MINUTE TYPING MEASURE

Please read the following instructions carefully:

Once **C:\>** appears on the screen, type the sentence shown below. If you finish typing it before one minute is up, repeat typing it until one minute is expired.

Once a minute is gone, count the number of correctly typed words you entered and put that number on your exercise score sheet where TYPING SPEED:____________ is provided.

The quick brown fox jumped over the lazy dog's hairy back.

Once you record your score, proceed to part I of the exercise.

APPENDIX D

SLS 1101 WORD-PROCESSING EXERCISE, PART I

Take a moment and read over all of Part I of the exercise before you attempt to do it. You should start up your computer normally and follow whatever network demands are necessary to access WordPerfect and get a printout from the local K259 printer.

When you get W:\WP\WP51> on your screen you are ready to begin the assignment. The word-processing package WordPerfect 5.1 can be accessed by typing WP at the W:\WP\WP51> prompt.

Remember you can ask Mr. Ward for help anytime during the first part of the exercise and you will not lose any points!

Using your own and recently learned organizing and computer skills do the following:

a) Load the word-processing package
b) Type carefully the following paragraph, including the title.

FISHES

Fishes in the Caribbean Sea vary widely in their size and color patterns. Your first encounter with the great white shark is never forgotten. When you first see the great white you are awestruck by its cool gray color and the immense size of it's mouth. Correspondingly, who isn't overwhelmed by the beauty of the tiny coral fish with it's blindingly bright blue and red colored stripes. The wide variety of fishes in the Caribbean Sea make it an ideal place to see nature's work.

---

c) Save the document to the data disk. The document name is Fish .
d) Quit the program (If you did the SAVE and EXIT procedure you should be out.)
f) W:\WP\WP51> prompt should appear on your screen.
g) Turn in this paper to Mr. Ward.

COLLEGE SUCCESS WORD-PROCESSING EXERCISE, PART II

No questions can be answered by Mr. Ward for part II of the exercise unless absolutely necessary. For help, pay particular attention to the reference materials and the WP template above the keyboard.

You should be take about ten minutes to complete part II of the assignment.

h) Reload the word-processing package
i) Retrieve the document named FISH .
j) Make the following changes:
    1) Delete the phrase Caribbean Sea in both places.
    2) Insert in their places Gulf of Mexico .
    3) Delete the phrase tiny coral fish .
    4) Insert in its place delicate bonefish .
    5) Add the following sentence at the end of the paragraph:
       So when are you going to visit!
    6) Using WordPerfect's Center Function, center the title FISHES .
k) Print the changed document.
l) Save the document to the disk as FISH .
m) Quit the Program. Use the SAVE and EXIT procedure. Hint: Start by pressing F7 .
n) W:\WP\WP51> prompt should appear on your screen.
o) Type C: and press the ENTER key.
p) Turn in the printout and the datadisk to Mr. Ward when you are finished.

APPENDIX E

SLS 1101 STUDENT COMPUTER EXERCISE FORM

Student Name: ______________________________

Student SS#: _______________________________

Teacher: ___________________________________

Previous WP or other computer software experience:

< > YES < > NO

Typing Speed : __________________________

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Part I: Known Software, Questions Answered, No Time Limit

Time Began: _______________________

Time End: _________________________

Time Elapsed: _____________________

Questions Asked: _______________________________________

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Total Questions Asked: __________

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Part II: Known Software, No Questions Answered UNLESS NECESSARY, Ten (10) Minute Limit Suggested.

Time Began: _______________________

Time End: _________________________

Time Elapsed: _____________________

Questions Asked: _______________________________________

____

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____

____

Total Questions Asked: __________

APPENDIX F

CGS 1000 WORD-PROCESSING EXERCISE, PART I

Take a moment and read over the entire exercise before you attempt to do it.

You should start up your computer normally. When you get **C:\>** on your screen you are ready to begin the assignment. The word-processing package, BANK STREET WRITER III, is stored on a sub-directory called BSW.
After changing to the sub-directory BSW, type BSW to start the program.

Remember you can ask Mr. Ward for help anytime during this part of the exercise and will not lose any points!

There is no time limit for this part. However, it should not take you more than 20 minutes to complete this section.

Using your own and recently learned organizing and computer skills do the following:

a) Load the unknown word-processing package
b) Type the following paragraph

BRIDGES

Bridges in the United States vary widely in their size, shape and design. Almost everyone, when they first see the Golden Gate Bridge in San Francisco, California, are struck with awe at the immense size and graceful design of the bridge. Correspondingly, who isn't filled with warmth and sense of history when they cross the famous covered wooden bridge located on U.S. Highway 17 near Concord, Massachusetts. So when you next cross a bridge, remember it is more than just a short cut for getting from point A to Point B.

---

c) Save the document to the data disk. The document name is
BRIDGE .
d) Print the document.
e) Quit the program.
f) Turn off the computer.
g) Turn in the printed document to Mr. Ward

INTRODUCTION TO COMPUTERS WORD-PROCESSING EXERCISE, PART II

No questions can be answered by Mr. Ward for part II of the exercise, unless absolutely necessary. For help pay particular attention to the reference manual.

You should only need ten minutes to complete part II of the assignment.

h) Reload the word-processing package
i) Retrieve the document named BRIDGE .
j) Make the following changes:

1) Delete the phrase Concord, Massachusetts .
2) Insert in its place Bridgeport, Connecticut .
3) Add the following sentence at the end of the paragraph:
Bridges are things of beauty too!
4) Delete the phrase U.S. Highway 17 .
5) Insert in its place State Road 118 .
6) Using BSW's CENTER Function, center the title BRIDGES .

k) Save the document to the disk as BRIDGE .
l) Print the changed document.
m) Quit the Program.
n) Turn off the computer.

Turn in your supplied materials and your second printout to Mr. Ward when you are finished.

APPENDIX G
CGS 1000 STUDENT COMPUTER EXERCISE FORM

Student Name: ____________________________
Student SS#: ______________________________
Teacher: __________________________________
Previous WP or other computer software experience: < > YES < > NO
Typing Speed : ________________________

==

Part I: Unknown Software, Questions Answered, No Time Limit

Time Began: ____________________
Time End: ______________________
Time Elapsed: __________________

Questions Asked:

____
____
____
____
____
____

Total Questions Asked: _________

==

Part II: Unknown Software, No Questions Answered UNLESS NECESSARY, Ten (10) Minute Limit Suggested

Time Began: ____________________
Time End: ______________________
Time Elapsed: __________________

Questions Asked: ____________________________________
____
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____
____

Total Questions Asked: _________

APPENDIX H
CGS 1000 POSTCOURSE SURVEY

December, 1992

CONFIDENTIAL
Student ID _ _ _ _ _

Please write the first letter of your last name followed by the last 4 digits of your social security number.
For example, Carl Benson, 123-45-6789 would write B 6 7 8 9.

In order to better serve you and other adults' computer education needs, we need your help. Please take a minute to complete the survey. Your cooperation will allow this institution to create computer workshops, courses and complete programs especially suited to meet our community's needs. Feel free, however, not to answer a question or questions if you don't wish to do so.

Thank you in advance for your cooperation.
It will make a difference!

PLEASE CHECK ONLY ONE CHOICE FOR EACH QUESTION OR SECTION.

1) AFTER TAKING THIS COMPUTER COURSE, I EXPECT FUTURE COMPUTER COURSES OR WORKSHOPS I WILL TAKE WILL BE: (CHECK ONLY ONE)

< > Fun
< > Easy
< > Interesting
< > Challenging
< > Difficult
< > Stressful

2) Imagine it is six months from now. You are given an unknown software package to use. How confident are you that ON YOUR OWN you would be able to figure out how to use it. CHECK ONLY ONE)

< > Very Confident
< > Somewhat Confident
< > Confident
< > Unconfident
< > Somewhat Unconfident
< > Very Unconfident

You are almost finished with your present computer course. Based upon your experiences in this course, how likely are you to take the following courses or workshops in the next two years. Please check your choice for **EACH** of the types of courses or workshops listed below (Questions 3 through 13):

SKIP ANY QUESTION FOR WHICH YOU HAVE NO INTEREST.

3) Keyboarding Skills (Typing positions, Hand placement, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

4) Introduction to Computers (Terms, Definitions, Computer consumer tips, Hands-on exercises, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

5) Word Processing (Letters, Memos, Reports, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

6) Desk Top Publishing (Newsletters, Presentations, Reports, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

7) Multi-Media (Computer-driven presentations, lessons, knowledge CD-ROM searches, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

8) Spreadsheets (General ledgers, statistical reports, financial statements, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

9) Data Bases (Files, Records, Report Generations, Inquiries, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

10) Telecommunications (Computer Bulletin Boards, Electronic Mail, Electronic Shopping, etc):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

11) Graphics (Drafting, Commercial Art, Drawing, etc):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

12) Computer Networks (Novell, LANS, Small or Large setups, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

13) Programming (COBOL, BASIC, FORTRAN, C, ASSEMBLER, MODULA 2, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

Based upon your experiences in this course, how likely are you, **ON YOUR OWN**, to attempt to learn to use the following types of software packages in the next two years. Please check your choice for **EACH** of the types of software packages listed below
(Questions 14 through 24):

SKIP ANY QUESTION FOR WHICH YOU HAVE NO INTEREST.

14) Keyboarding Skills (Typing positions, Hand placement, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

15) Introduction to Computers (Terms, Definitions, Computer consumer tips, Hands-on exercises, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

16) Word Processing (Letters, Memos, Reports, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

17) Desk Top Publishing (Newsletters, Presentations, Reports, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

18) Multi-Media (Computer-driven presentations, lessons, knowledge CD-ROM searches, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

19) Spreadsheets (General ledgers, statistical reports, financial statements, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

20) Data Bases (Files, Records, Report Generations, Inquiries, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

21) Telecommunications (Computer Bulletin Boards, Electronic Mail, Electronic Shopping, etc):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

22) Graphics (Drafting, Commercial Art, Drawing, etc):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

23) Computer Networks (Novell, LANS, Small or Large setups, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

24) Programming (COBOL, BASIC, FORTRAN, C, ASSEMBLER, MODULA 2, etc.):
< > Not Likely < > Somewhat Likely < > Likely < > Very Likely

25) DID YOU ATTEMPT THE EXTRA CREDIT WORD-PROCESSING EXERCISE?

< > Yes

< > No

IF YOU CHECKED 'Yes' PLEASE ANSWER THE FOLLOWING QUESTIONS, IF YOU CHECKED 'No', STOP NOW AND TURN IN THE SURVEY. THANK YOU.

26) Which of the following actions helped you the MOST to do the extra credit word-processing exercise.
(CHECK ONLY ONE)

< > Asking the monitoring teacher specific questions.
< > Looking through the reference manual.
< > Previous word-processing experience.
< > Previous computer software experience.
< > Skills I learned in my present computer course.
< > Previously acquired general organizing skills.
< > Other

27) Which of the following actions helped you the LEAST to do the extra credit word-processing exercise.
(CHECK ONLY ONE)

< > Asking the monitoring teacher specific questions.
< > Looking through the reference manual.
< > Previous word-processing experience.
< > Previous computer software experience.
< > Skills I learned in my present computer course.
< > Previously acquired general organizing skills.
< > Other

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BIOGRAPHICAL SKETCH

Hugh C. Ward, Jr., received his Bachelor of Science degree in 1969 and Master of Education degree in 1972, both from the University of Florida. He has been an educator for over 20 years in a variety of educational institutions ranging from middle schools to universities. Seeing a need for educational software and software support in 1980, he formed his own educational software and consulting company, H. C. Ward Co., which he continues to operate today. Currently, he is a mathematics and science instructor at Seminole Community College in Sanford, Florida.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Education.

Elroy J. Bolduc, Chairman
Professor of Instruction and Curriculum

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Education.

Eleanore L. Kantowski
Professor of Instruction and Curriculum

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Education.

Regina Weade
Associate Professor of Instruction and Curriculum

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Education.

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This dissertation was submitted to the Graduate Faculty of the College of Education and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Education.

April 1994

Dean, College of Education

Dean, Graduate School