THE EFFECTS OF IN-SERVICE WORKSHOPS ON COMPUTER ANXIETY IN ELEMENTARY TEACHERS

by

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DEDICATION

This dissertation is dedicated to

, my friend,

my sounding board,

my constant source of strength.

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TABLE OF CONTENTS

DEDICATION ii

ACKNOWLEDGMENTS iii

LIST OF TABLES vii

CHAPTER

I. INTRODUCTION 1

NEED FOR THE STUDY 7

PURPOSE OF THE STUDY 10

ORGANIZATION OF THE STUDY 12

II. REVIEW OF THE LITERATURE 13

COMPUTER ANXIETY 13

FACULTY RELUCTANCE 19

COMPUTER INSTRUCTION FOR TEACHERS 25

WORKSHOPS 29

III. METHODOLOGY 41

RESEARCH DESIGN 42

Sampling Procedures 43

Definition of Terms 44

TREATMENT DESIGN 46

Principles 47

Workshop Content 49

Workshop Process 51

Workshop Implementation 53

Measurement 54

IV. RESULTS 63
PRE-WORKSHOP MEASUREMENTS 64
Computer Background Information 64
Trait Anxiety 65
Computer Literacy 66
State Anxiety 67
POST-WORKSHOP MEASUREMENTS 68
State Anxiety 68
CLAA (Part I) 69
LOGO quiz 70
CROSSTABULATIONS 70
BEHAVIORAL MEASURES 71
COMPARISON OF TRAIT ANXIETY WITH SCORES . 72
V. CONCLUSIONS 74
Conclusions 75
Limitations 81
Recommendations 81
REFERENCES 83
APPENDICES 88
A. EDUCATIONAL INNOVATION SURVEY 89
B. WORKSHOP SESSION OUTLINES 92
C. WORKSHOP DESCRIPTION BY OBSERVERS 101
D. PRE-WORKSHOP MEASUREMENTS 117
E. STATE SECTION (STAI) 130
F. VIRGINIA TECH EMBLEM 132

G. COMPUTER USE FORM 139

H. POST-WORKSHOP MEASUREMENTS 141

I. COMPUTER BACKGROUND INFORMATION RESULTS . . 148

J. COMPUTER LITERACY RESULTS 152

K. LOGO QUIZ RESULTS 165

L. ANOVA SUMMARY TABLES 169

VITA 172

ABSTRACT

LIST OF TABLES

1. Number of Elementary Teachers in Treatment and Quasi-Control Groups 45

2. Test Administration 56

3. Alpha Reliability for the Cognitive Subtests . . 58

4. Alpha Reliability for the Affective Scales . . . 61

CHAPTER I

Introduction

> Messages and memos move silently and instantaneously. Terminals at every desk - thousands of them in any large organization - flicker quietly as information flows through the system, bouncing up to a satellite and down to an office half-way around the world or to a terminal in an executive's home. Computers link the company's files with those of other companies when necessary, and managers can call up information stored in hundreds of outside data banks like the New York Times Information Bank. (Toffler, 1980, p. 190).

Toffler's futuristic description would have seemed an unrealistic prediction to folks in the 1950's when there were only about 15 computers being used in the United States. Today, however, the computer is rapidly

becoming a normal piece of equipment for home and office. The emergence of computers has placed an enormous burden upon the field of education. Public schools and universities are being pressured by parents and students to provide computer awareness and programming instruction. Accompanying these requests are demands upon teachers to become sufficiently articulate in the matters of computer history, architecture, and programming design. At a time when teachers feel they are not paid enough for their current responsibilities, they are not apt to tackle the task of learning computer operation when there are no monetary rewards for their efforts (Rohner and Simonson, 1981). Programming classes offered through universities and community colleges are expensive and time-consuming. Few teachers volunteer to spend both limited time and money on training that could be offered at no cost through their local school systems.

The Carnegie Commission on Higher Education (1972) suggested four major revolutions in education. The first occurred when the responsibility of educating the young was transferred from the immediate family to an outsider specifically designated to teach. The development of writing offered the possibility of

recording stories and folk tales whose survival had previously depended upon reliable yarn spinners. With the invention of the printing press the availability of books increased tremendously. Today we find ourselves experiencing a fourth revolution; a technological revolution which is quickly expanding our capabilities to process information.

According to Rohner and Simonson (1981), each of these revolutions has been accompanied by resistance from parents and teachers. Zemke (1984) related that resistance is a normal component of the change process and is obvious in training situations.

Upon reviewing the literature concerning educational innovation, Rohner and Simonson (1981) discovered the following reasons for teacher resistance:

1. Teachers fear that machines will eventually replace them.
2. Teachers did not welcome change because there were no rewards for accepting innovations.
3. Teachers need to be independent and in the "spotlight."
4. Teachers suffer role overload if they attempt to do too much.

5. Teachers do not wish to make the changes necessary to accept the innovation.
6. Teachers often feel that they and their students are dehumanized by additional technology.
7. Teachers realize that resources for new innovations are often lacking.

Since the introduction of the microcomputer in the 1970's, it has invaded industry, business, education and the home. Walsh predicted in 1982 that the number of school-based microcomputers (235,000) would double by 1985. Bender and Conrad (1984) reported that at last count, there were over 100,000 systems in high schools alone. Jennings (1984) expects the number of small computers to grow from 5,000,000 to 26,000,000 by 1986.

There are mixed reactions to the microcomputer's potential. While some view it as a useful tool or an amusing toy, others feel personally threatened by its mindboggling capabilities. Other responses fall somewhere on the continuum between curiosity and uncertainty (Widmer and Parker, 1983).

Technological advancements have thrust computers into the laps of those who are afraid of their power, speed, and computational capabilities. The fear described by individuals who have been forced to incorporate computers into their educational or industrial environments has been termed "computer anxiety" (Seidel and Rubin, 1977). Widmer and Parker (1983) noted that although math anxiety has become a commonly accepted phenomenon, the issue of computer anxiety needs to be addressed. Math anxiety has often been attributed to negative experiences in elementary school. Since computers are relatively new to us, we can hardly afford computer anxiety a similar explanation. Rather computer anxiety seems to be based upon a common cause of anxiety: fear of the unknown (Widmer and Parker, 1983).

Quinsaat (1981) accounted for computer anxiety by suggesting that adults have had to make accommodations for the presence of computers whereas computers have been a natural part of the child's environment. The adult's anxiety is not lessened by the ease in which his children have adjusted to computers (Widmer and Parker, 1983).

Jennings (1984) related that things which differ in size or behavior often create feelings of fear in

humans. Computers are frightening to people because they are capable of handling huge amounts of information in a quick, logical manner. Although people appreciate tools which can serve as extensions of their bodies, they tend to consider the computer a threat. Jennings (1984) predicted these feelings will change as humans realize that computers can be mastered and even modified to meet individual needs. Keyboard barriers can be eliminated through the use of touch screen controls, a mouse or joysticks. Engineers will continue to increase the capability as well as decrease the size and cost of the computer. Because computers were first introduced through big business and government use, they have maintained a certain awesomeness. Some computer owners respect the computer's ability but secretly fear a table-turning event in which the computer will assume the master role and gain control over the human race.

Educators cannot ignore the technological revolution much longer. Teacher in-service must be modified in order to accommodate teacher needs. By appropriate training and development of certain technical competencies, teacher fears may be diminished (Payne, 1983).

Need for the Study

Teachers are expressing a number of concerns regarding the effects of new technology on the teaching profession. Computers are viewed as being nonhumanistic; one can envision children being programmed by computers rather than computers being programmed by children. Computers are also threatening to the teacher's job security. The haunting fear of being replaced by a keyboard-driven instructor is real in the minds of many who have dedicated their lives to education (Quinsaat, 1981).

If teachers are responsible for preparing youngsters for survival in a technological society, they must overcome their own frustrations and gain familiarity with computers (Knight, 1979). Teacher computer anxiety can certainly be a detriment to the advancement of computer utilization in the school setting (Rohner and Simonson, 1983). Michelson (1974) claimed that a reluctance by educators to learn new things is shameful when they encourage students to continue to learn and adapt.

Because educators are faced with the responsibility of preparing a workforce capable of survival in an automated marketplace, education is shifting from a teaching/learning model to a combination of teachers and machines. Dede (1983) suggested that the speed of this transformation will depend on the degree of educators' resistance to their changing roles. Many teaching functions may be transferred to computers since they allow greater opportunities for individualization, use little space, cost less and are more easily updated than textbooks. Dede created an image of "machine-mediated training and human-based education" which is possible through teacher/tool partnerships.

If computer technology in education is being hampered by teacher computer anxiety, teacher trainers must discover methods of computer anxiety reduction. Rohner and Simonson (1981) described computer anxiety as a mixture of fear, apprehension and hope when faced with interaction with a computer. An innovative reading program would be given careful introduction into a school system. Needs would be analyzed, the advantages and disadvantages would be weighed, supplemental materials would be previewed and in-service training would be offered. School leaders also should guarantee

that such preparations be made for the entrance of the computer into the curriculum.

Most middle and high school teachers may have escaped the pressure to become computer literate. When computer labs are financed and equipped through a school system, the responsibility of instruction usually falls upon the math teachers. How interesting that the very educators who have had to combat math anxiety in students are now battling computer anxiety among their colleagues! Once a teacher becomes a competent computer user, he may be required to offer instruction to teachers on his faculty. Computer instruction, then, becomes dependent upon the expertise of members of individual faculties. At the present time, however, there may be little pressure upon subject area teachers to become computer literate.

Many elementary teachers have computer equipment available in their schools but have had minimal training concerning efficient classroom computer use. Therefore there are huge differences among elementary classrooms in regard to student exposure to computers. Although elementary teachers are expected to offer instruction in all areas, many will wait until state certification requirements force them into computer literacy classes.

If computer anxiety is based upon a fear of the unknown (Widmer and Parker, 1983), then training which entails familiarization, simple programming, and hands-on experience must be offered teachers. The phenomenon of computer anxiety must be explored and addressed if computer instruction is to be successfully implemented into elementary classrooms.

Purpose of the Study

Educational innovation is often accompanied by resistance from parents and teachers. Teacher resistance to computers may stem from the frightening prediction that machines will eventually replace human instructors. Such fear has been termed "computer anxiety" and may account for teacher hesitancy to explore computer capabilities.

If teacher computer anxiety creates a barrier to increasing the use of educational technology, teacher trainers must assume the task of computer anxiety reduction. Computer training for teachers should include familiarization, simple programming, and hands-on computer experience.

The purpose of this study was to investigate the effect of workshops which are designed to reduce teacher computer anxiety. Rottier (1982) suggested that successful anxiety reduction workshops for teachers and administrators develop feelings of confidence concerning computer use. Widmer and Parker (1983) and Payne (1983) encouraged teacher workshops which allow positive initial interaction with computers. Hands-on experience was stressed as a vital component of teacher workshops.

Although teachers may fear being replaced by computers, Dede (1983) suggested that they may happily discover that technological advances may lead to the improvement of basic instruction, allow the inclusion of advanced courses previously considered too costly, improve educational research, and increase the student/teacher ratio without diluting the quality of instruction.

Organization of the Study

Chapter I has presented the introduction, the need and purpose of the study. Chapter II contains a literature review of related research. Chapter III contains methodology including workshop format. Chapter IV includes the data analysis and Chapter V discusses interpretations, conclusions and recommendations.

CHAPTER II

Review of the Literature

Since this study is directed toward the reduction of teacher computer anxiety, the review of literature was guided by an intent to acknowledge research on topics relevant to that problem. The first part of this chapter provides some discussion of computer anxiety and the resultant faculty reluctance to computer implementation. The second half of the chapter presents the need for teacher instruction and discusses the potential of in-service workshops.

Computer Anxiety

Although "computerphobia" may be too strong a definition for the fear that educators exhibit in regard to computers (Zemke, 1984), there is significant evidence of computer apprehension among teachers and administrators. Zemke mentioned several conclusions concerning fear of computers that have been supported by recent research.

These included:

1. People without computer experience are more anxious than people with computer experience (in general) when confronted by a computer-based training task.
2. Regardless of previous experience with computers, people faced with a new and unfamiliar computer task are measurably anxious.
3. Hands-on experience with the specific computer tasks creating anxiety tends to reduce that anxiety.
4. People with a tendency to have anxious responses to other situations, such as taking tests and facing changes in their personal lives, also tend to become anxious about computers and tasks that involve computers.

Zemke drew a comparison between computer use and a number of unfamiliar tasks such as driving a car or playing tennis. Again the fear of the unknown is the basis for apprehension.

An index of computer anxiety has been developed by Rohner and Simonson (1981). The Educational Innovation Survey (included in Appendix A) contains 30 statements, 20 of which are distractors in reference to other innovations. The ten target statements refer directly to computer use. The index has been correlated to traits including sex, subject area, cerebral dominance, and field independence/field dependence. Unexpectedly, there were no statistically significant relationships between computer anxiety and any of the measured traits.

Throughout the 1960's Tobias completed several studies which examined teachers' attitudes toward instructional media. In 1978 Tobias and Everson addressed the issue of teachers' fear of automation. One hundred twelve teachers and prospective teachers were asked to rate their attitudes toward ten terms relating to traditional or contemporary instructional technology. Traditional terms included such instructional devices as flashcard, workbook, and filmstrip. Contemporary terms used were computer managed instruction, automated instruction, and computer based instruction. Three conditions could be used as modifiers of each term. The replacement condition connoted "replacement of the teacher," the adjunct

condition expressed "direction from the teacher," and the neutral condition placed no modifiers upon terms. For instance, computer based instruction was presented in three perspectives: merely as "computer based instruction" or "computer based instruction directed by the teacher" or "computer based instruction to replace the teacher."

Results of this study revealed that the more traditional terms created more positive attitudes than the contemporary terms. The neutral and adjunct groups gained more favorable responses than did the replacement group. Tobias and Everson's study suggested that teachers fear being replaced by technological equipment. The authors encouraged educational instructors to attend to teacher attitudes when introducing innovations. Failure to do so may cause teachers to negatively affect student attitudes toward new instructional media.

In a subsequent study Everson (1979) compared teacher education and computer science majors' attitudes toward instructional media. Attitudinal responses were elicited concerning traditional and automated media. The results indicated that teacher education majors felt more positively toward traditional instructional devices than automated media. Although computer science majors

were expected to have more positive attitudes toward the automated instruction, the data did not support this hypothesis.

Everson reiterated the responsibility of those who design workshops to introduce instructional innovations in a nonthreatening atmosphere, providing careful guidance for teachers. He encouraged teacher assurance that instructional innovations will enhance (not replace) their personal contributions to education.

Michelson (1974) has concluded that people are not choosing to learn to program computers because they are convinced that improving technology is daily making that process easier. Teachers are guilty of resisting computers while at the same time encouraging their students to accept innovations and learn new things. It is indeed a simpler task for a teacher to have a guest computer specialist explain the fundamentals than spend the time necessary to learn them. Michelson suggested the employment of a programmer/teacher responsible for offering computer instruction as well as development of programs needed in the individual classrooms. Faculty members who are frightened by computers should never be rushed into using them.

The literature concerning computer anxiety indicates that this phenomenon may be caused by a lack of computer experience and most greatly affects individuals who tend to be anxious in other situations. Several studies have focused upon computer anxiety in an effort to identify attitudes which underlie it. Rohner and Simonson's anxiety index failed to correlate individual traits such as sex and cerebral dominance with computer anxiety. Tobias and Everson attempted to differentiate between the attitudes of teacher education and computer science majors toward traditional and automated media. Their studies revealed that most students, regardless of college major, had more positive attitudes toward traditional instuctional media. Due to the evidence of negative attitudes toward automated media which may result in some degree of computer anxiety, the literature supported the importance of introducing computers in a nonthreatening atmosphere wherein teachers are given careful direction for investigating the computer's potential.

Faculty Reluctance

Computer implementation may be hindered in education because although software is available, it is expensive and rarely appropriate for specific instructional needs. Because of this problem, teachers must tailor their classes to fit the software rather than using the software to supplement lessons. Further problems are caused when there are 20 students and only 1 computer. Even when the student is given computer time, he may discover that the computer requires more specific input than he wishes to give. Loftus (1982) reported that students resented the computer's insistence for accuracy, the need to type on an unfamiliar keyboard, and the inaccessibility of machines. Even when terminals were accessible, there were always difficulties with machine malfunctions, slowness of computer response, and sometimes other people tampered with programs, erasing many hours of work. Teachers disliked the possibility of students cheating when allowed to complete tests outside of class because there was no method of monitoring whether a student gained assistance from materials or friends.

With all these problems facing teachers, many of them are reluctant to use computers. Although state certification requirements are being revised to include some computer education, most currently-employed educators have had little technological training (Diem, 1984). Loftus suggested that as younger teachers enter education, many of these problems will be automatically eliminated because technology will have played a more vital role in the younger teachers' training. Computer missionaries, those few who attempt to "win" others to computer use, should draw their attention to the younger members of the faculty who may prove more receptive to the computer's potential instructional use. Lewis (1983) supported computer familiarization for all educators and teacher training for all levels of interest.

Spero (1982) became concerned about the lack of faculty computer use on the Cuyahoga Community College campus in Cleveland, Ohio. Facilities included a Honeywell Level VI with 30 terminals and a 16-terminal PLATO computer. The faculty had been encouraged to utilize the available software and facilities. Intrigued by the faculty's resistance to this instructional innovation, Spero concluded that this

reaction was based on the computer anxiety phenomenon and that hands-on experience would reduce such anxiety.

An instructional development grant of $3,000 and an ATARI "Buy two, get one free" deal provided nine ATARI 400 microcomputers which Spero offered to faculty members for home use for a total of 10 weeks. Each participant was required to attend a two-hour weekly meeting. Twenty faculty members reported to the first meeting. This overwhelming response prompted the administration to double the number of available machines. As computers were distributed in the initial workshop, participants received instructions for proper connection of computers to television sets as well as cassette loading and saving techniques. Weekly meetings afforded question and answer sessions, demonstrations of programs and discussion of potential instructional use.

At the close of the quarter, Spero reported that not only had faculty members overcome their anxiety, but were making definite plans for utilizing the campus computer facilities within their particular subject areas.

Heydinger (1978) cited the obstacles to computer conferencing as faculty reluctance to the innovation, limited terminal accessibility, computer anxiety, and

the amount of time required to learn computer operation. Many students enter universities with limited computer experience. They may suffer from computer phobia or frustration concerning keyboard manipulation. Once students gain some familiarity with computer use, they may be plagued with unforeseen problems such as communication errors or system crashes. These negative factors may result in student refusal to participate in computer activities such as conferencing even if end results may be rewarding.

Heydinger (1978) found that effective computer conferencing between university faculty and students required a careful introductory period. Faculty reluctance to utilize the computer as a communication tool and computer phobia among many prospective participants inhibited the growth of computer conferencing. He suggested that increased familiarity with conferencing techniques would reduce computer use resistance.

An effective method of enhancing teacher interest in using computers as instructional tools was conceived by Lippey (1974). He suggested that teachers use computers to prepare tests for the basic subjects of Math, Social Studies, Science, and Language Arts. The

computer program would serve as a centralized storage bank of questions for each subject. A test could be constructed by selecting specific or random questions. Teachers within subject areas could share questions; feedback from other teachers may tend to improve the quality of test items. There would be no need to store or destroy old mimeographed or xeroxed tests; no two computerized tests need ever be the same. Successful use of the test construction technique may extend into wider computer use.

A 1983 survey by the Center for Social Organization of Schools revealed that the average elementary student gets less than 30 minutes a week on a computer. One-third of elementary users gets 15 minutes or less per week which averages to about 3 minutes a day. The survey further determined that elementary schools which acquire additional computers do not increase individual student time; however, they increase the number of students who are given access to the computer (Maddux, 1984).

Faculty reluctance toward computer use must be diminished. Teachers must realize that the computer will not replace them or their classrooms (Wallisch, 1983). It can, however, serve as a management and

instructional tool which frees the teacher to provide increased individual attention to students. Wallisch (1983) commented:

> . . . these teachers must not fear or reject the tools at hand. Rather they must take control of them. Just as blackboards stand cold and lifeless in the night, so shall the new teaching machines be useless without gifted, sensitive, human leadership. (p. 105)

Several conclusions may be drawn from the studies regarding faculty reluctance. The literature revealed that the emergence of computers on the educational scene has created several problems for teachers. Instructionally inappropriate software, insufficient machine accessibility and lack of teacher training have delayed successful implementation of computers. Additional problems include keyboard unfamiliarity, machine malfunctions, and difficulty in preventing student misuse of computers. These obstacles have caused teacher reluctance toward using computers as instructional and/or communication devices.

Spero concluded that faculty resistance to computers was based on computer anxiety and that such anxiety might be reduced by hands-on experience. By offering computers for free home use and providing weekly instruction and interchange among the study participants, Spero discovered that faculty members reported anxiety reduction as well as plans for computer implementation within their instructional areas. Heydinger and Lippey suggested that faculty reluctance toward computers could be diminished by demonstrating to teachers the computer's potential as an instructional tool.

Computer Instruction for Teachers

School systems are quickly adopting computer technology, but teachers and administrators need a comprehensive computer training program which prepares educators for the introduction and implementation of the new technology (Telem, 1984). Carrier and Lambrecht (1984) reported that in 1973 the Minnesota state legislature appropriated funds for the establishment of the Minnesota Educational Computing Consortium (MECC). That same support created a $6.5 million grant in 1983

to further computer use in Minnesota schools. A Computer Task Force was charged with the responsibility of determining necessary components for computer literacy for preservice teachers. The group adapted Watt's (1980) definition of computer literacy:

1. Knowledge of basic computer components and operation.
2. Knowledge of materials and projects related to computer education.
3. Knowledge of educational and personal uses of computers.
4. Knowledge of individual differences as they relate to computer-assisted learning.
5. Evaluating instructional software.
6. Ability to develop/manage an environment in which computers are available for teaching/learning.
7. Knowledge of educational and societal implications of the "information age."
8. Ability to use authoring languages and to program.

Klassen (1983) reported that the 1983 College Board Academic Preparation for College: What Students Need to Know included the following: "Students should be able to hold a simple conversation in a foreign language, appreciate music and theater, and know how to operate a computer." Colleges are increasingly being expected to play important roles in implementing new technology. Klassen suggested several goals: 1) defining computer literacy, 2) defining needed instructional programs, 3) providing facilities, personnel, 4) helping institutions manage information, and 5) becoming computer literate ourselves. Obstacles inhibiting these goals include unprepared or reluctant faculties, the need for academic restructuring, a rapidly growing student course demand, and computer fear or anxiety. The two main reasons for dealing with computer fear include the personal benefits derived from adapting to computer use and the educator's obligation to the educational institution to keep in step with innovative technology.

The Far West Laboratory sponsored an Independent Research and Development Project which explored the microcomputer learning environment. Loop and Christensen (1980) entitled this project CALES: Computer Augmented Learning Environments. They

diagnosed several stages through which individuals pass in regard to computer use. People have to initially overcome their fear of technology, specifically computers. A curiosity must result in questioning. An understanding of the relationship between computer components creates a feeling of being in control of the computer. The ability to manipulate commercial programs may reveal the potential of the computer as an instructional tool. Once these stages have been successfully completed, the user may proceed to construct programs which fit his individual needs.

In conclusion, the need for computer instruction for teachers was evident in the literature. Telem (1984) related that while school systems are supporting technology by increasing the availability of computers, they are failing to offer training for teachers who will be responsible for computer implementation. The Minnesota Educational Computing Consortium attempted to determine the necessary components for computer literacy for teachers. These objectives have emphasized computer knowledge concerning machine components, educational materials and uses, and computer-assisted learning. The Far West Laboratory diagnosed stages through which individuals pass in the process of gaining control of

computers. These researchers determined that once computer fear is sufficiently reduced, the next step is the development of an understanding of the relationship between computer components.

Workshops

Filliman (1983) suggested several important steps in framing a model for inservice training for teachers. Scope and sequence objectives developed by the school district should be deliberately planned and teachers should definitely have ample hands-on time to explore the computer's capabilities. She wrote, "To insure success in the classroom, teachers need to reach a comfort level commensurate with the uninhibited nature and eagerness that students have toward computers." Effective and precise training activities must be developed in order for teachers to learn how to use, program, and teach with microcomputers (Grossnickle and Laird, 1983). Rubin's (1978) Postulates for In-Service Training included the following principles for microcomputer training success:

1. In-service should increase the competence of the teacher.

2. Teacher retraining should be dealt with in small, discreet units.
3. Training activities should be in sequence so that teachers can progress through a cycle of units that increase in complexity.
4. The unit should be flexible to allow teachers to begin at their own ability levels.
5. In-service should take place during the teacher's work day.
6. In-service should not interfere with individuality in teaching.
7. In-service should advance educational innovation whenever possible.
8. Teacher in-service is enhanced when the total school staff is involved.

Rubin emphasized that training should be relevant to existing instructional settings and that a trained technical resource person should be available following in-service. Several authors supported the importance of feedback in the training situation. Olivero (1970) suggested that the process of feedback in teacher training simply provides knowledge of results. Immediate sources of feedback include questioning, visual cues, and informal performance evaluation.

Successful training programs offer feedback as teachers work on problems so that a foundation for correction and revision is available (Tyler, 1971). Fischer (1971) related that the potential of feedback in in-service education is dependent on alert, objective in-service instructors. Edelfelt and Lawrence (1975) ranked feedback as one of three major components of in-service education. They commented:

> Inservice education programs that emphasize demonstrations, supervised trials and feedback are more likely to accomplish their goals than are programs in which the teachers are expected to store up ideas and behavior prescriptions for a future time. (p. 19)

Teachers must also be asked to submit feedback to the workshop instructor in order to evaluate the effectiveness of the instruction. This participant feedback provides a way of adding, eliminating, or modifying the procedures used within the workshop experience (Allen, 1971).

McMeen (1984) emphasized the importance of stimulating interest in computers across the curriculum in order to encourage workshop participants to envision computer use in their own particular subject areas. He suggested that the most effective workshop leaders are experienced colleagues from a variety of disciplines. Grossnickle and Laird (1983) and McMeen (1984) agreed that outside consultants and computer scientists may not be quickly received and may not be aware of faculty needs. Hands-on workshops should be horizontal across subject areas rather than vertical from computer specialists to teachers. The most important factor underlying teacher acceptance of innovations may be the recognition of instructional relevance to the existing curriculum. Heller (1982) put it simply:

> Teach me how to grasp a feeling for the total ability the computer has, what its limits are, what it can do, and what it can't do. Help me get some control over what it can do. Help me learn something useful to me. Don't waste a lot of time showing me all the fancy stuff it can do -- most of which I wouldn't even

> want to use now . . . Give me lots of "hands on experience" with this mysterious machine. But let those experiences be as useful to me as possible. (p. 89)

Rottier (1982) directed computer workshops for teachers and administrators with the main purpose of reducing computer tension. Through a series of questions, Rottier attempted to draw comparisons between the computer and a movie projector. He inquired if any workshop participants had used a 16mm movie projector, if they were comfortable with its use, if minor repair problems were easily solved, and if selection of appropriate films had been a simple task.

Further investigation revealed that about one-third of the participants had made their own home movies. Addressing this particular group, Rottier asked if they felt bad because they were not capable of producing a full-length film? This line of questioning aided teachers and administrators in the realization that they do not have to be technicians in order to use available technological innovations.

Both computers and movie projectors require hardware and can use commercial materials. Teachers

merely need to be capable of appropriate selection of software or films, deciding the purpose of the selection, and scheduling its use.

Knight (1979) felt that computer anxiety may merely be technological anxiety. While math anxiety has received much press the past few years, computer anxiety is not being addressed. Knight feared that educators are not sufficiently preparing students for life in a technological society; that teachers must deal with their own anxieties before assisting children in dealing with theirs. At the 57th Annual Convention of the National Council of Teachers of Mathematics in Boston in April 1979, Knight presented a paper entitled "Overcoming Computer Anxiety Through Games and Simulations." She supported game-playing as a method of reducing anxiety and increasing the user's comfort with computers.

Using 11 Radio Shack TRS-80's and 3 Digital Equipment Corporation minicomputers equipped with floppy disks, Knight used four demonstration techniques. First a lecture addressed the computer age, computer anxiety, and the values of game-playing on computers. The second technique involved a programmed sequence which explained the binary system. Participants were paired into

partners and asked to analyze a sample run from a completed game. Finally they were given the opportunity to play games. A different game was provided at each terminal location and participants were allowed to select freely.

An evaluative questionnaire revealed that game-playing was the most effective technique in reducing computer anxiety. Knight feels that it may have been the combination of activities that created a meaningful initial computer experience for the participants.

Widmer and Parker (1983) offered suggestions for workshops which allow positive computer interactions:

1. Choose various applications which are appropriate for the particular workshop group. Meaningful initial interactions will encourage further investigation.
2. Plan hands-on experience at least half of the workshop period. Stress the ease of using commercial software. Hands-on exercises grant participants a sense of control over the computer.

3. Pair participants in teams. Partners provide support and assistance.
4. Explain computer components and their functions. Resist using technical terms.
5. Encourage experimentation. Reassure participants that computers are not easily broken.
6. Teach some simple graphics. Mistakes in the graphics mode are more interesting than in the text mode.
7. Demonstrate the computer as a tool, not as a potential human replacement.
8. Suggest appropriate materials and activities to serve as follow-up for the workshop.

Payne (1983) has addressed the problem through the use of an in-service workshop geared to reduce teacher computer anxiety. She conceded that some teachers feel that computer use is much too difficult. Others know that the degree of computer implementation will not affect salaries. The in-service workshops were based on the teachers' need to experience actual computer use. Through this exercise it was hoped that teachers would

realize the benefits of utilizing the computer for testing, inventory, lesson plans, grade averaging, and individualization of instruction.

A West Kentucky Home Economics teacher survey resulted in the following needs: information on how computers can be used in Home Economics, increased computer awareness, help in alleviating computer anxiety, and hardware recommendations.

Small group workshops provided in-service for about 20 teachers of Home Economics. The keynote speaker was a high school principal who had conducted a state-wide survey regarding computer understanding which indicated that computer use would be supported by administrators in Kentucky. Following the opening address, sales representatives demonstrated hardware and software equipment. Several Home Economics teachers from Illinois who had developed software specifically for their classroom needs shared their successful computer experiences. The final session allowed teachers the opportunity to run some commercially-prepared software. Working in pairs, the teachers' initial fears of breaking the machines lessened as they became engrossed with the available programs.

An evaluation which was administered at the end of the in-service revealed an increased interest in computer use. Teachers requested follow-up sessions during which they could generate some basic tests. A further study evaluated the effectiveness of the workshops by comparing pre- and post-workshop attitudes with a resulting 31.8 percent ranking lack of instruction as the greatest detriment to educator computer use.

A needs assessment conducted with the workshop participants revealed interests in executing simple programs, using software, understanding computer terminology, locating educational computer resources, applying classroom computer instruction, and evaluating hardware and software. The teachers supported computer use as an additional tool to create varied instruction.

Payne (1983) offered some general suggestions regarding teacher computer workshops:

1. Know the needs of the teachers involved in the workshop.
2. Provide competent workshop leaders.
3. Be realistic about the amount of material covered in each workshop.

4. Reveal practical applications of computer use.
5. Plan hands-on experience in the workshop.

The need for in-service workshops was evident throughout the literature. There seemed to be agreement regarding the basic components for successful workshops. Several recommendations were consistently mentioned. Filliman (1983) and Payne (1983) suggested scope and sequence objectives which reflect the needs of the workshop participants. Widmer and Parker (1983) recommended an early explanation of computer hardware components. An understanding of the relationship between them creates for the user a feeling of control over the computer. The importance of hands-on experience was uniformly supported (Filliman, 1983; Grossnickle and Laird, 1983; McMeen, 1984; Knight, 1979; Widmer and Parker, 1983; and Payne, 1983). According to Knight (1979) hands-on experience increases the user's comfort with the computer.

Pairing workshop participants into partners provides a sense of teamwork and support (Knight, 1979; Widmer and Parker, 1983). Graphics can be introduced in

the early phases of the workshop. The encouragement of experimentation eventually reassures participants that the computers will not break if mistakes are made (Widmer and Parker, 1983).

A summary of the workshop literature has provided some basic foundations upon which successful computer workshops may be established. Grossnickle and Laird (1983) have described the aim of such workshops as teacher instruction on how to use, program and teach with computers. McMeen (1984) suggested activities which cause teachers to envision computers in their own classrooms; activities which are practical and instructionally relevant. Widmer and Parker (1983) recommended that appropriate materials be suggested for workshop follow-up. Rubin (1979) also supported the importance of an available resource person to field any questions following the in-service workshops.

CHAPTER III

Methodology

The technological revolution has thrust computers into classrooms before teachers have been able to comfortably cope with their powerful capabilities. The computer invasion into education has produced a population of computer anxious teachers; this anxiety has resulted in a reluctance to investigate the potential of the computer as an instructional tool. The literature on computer anxiety and teacher reluctance strongly suggested the need for carefully designed computer instruction for teachers. The literature also pointed to a number of factors which should enhance the value of in-service workshops as effective methods of providing teacher computer instruction. This study proposed to investigate the effectiveness of workshops which were based upon principles derived from the literature on in-service training and were designed to reduce computer anxiety while at the same time increase computer knowledge.

This investigation was designed to answer the following questions:

1. What effect does instruction delivered via a workshop model derived from the literature have on teacher computer knowledge and teacher computer anxiety?
2. Is there a relationship between teacher computer knowledge and teacher computer anxiety?

This chapter provides a description of the methodology to be utilized. The description includes the research design, the treatment design and a description of the implementation of treatment and measures.

Research Design

Three dependent variables were investigated on a pre-test and post-test or post-test only basis. They dealt with the affective, behavioral, and cognitive aspects of teacher reaction to the workshops. The pre-test and post-test instruments included an anxiety

measure which was determined by the State-Trait Anxiety Inventory. Portions of The Minnesota Computer Literacy and Awareness Assessment were used as pre-test and post-test measurements of teacher computer knowledge. A LOGO criterion test measured teacher cognitive growth and was administered as a post-test only. Measurement in behavioral areas were taken by trained observers who recorded participant behavior across the workshops. As additional measures of behavioral information, teacher responses in the form of LOGO programs and computer use forms were collected.

Sampling Procedures

The sample was drawn from the eleven elementary schools in Montgomery County, Virginia. There were ten elementary schools and one primary school in the district with classroom teacher groups ranging from 6 to 24. Additional staff members who chose to participate included principals, secretaries and librarians. Although these individuals received the same instruction as the teachers, no data concerning non-teaching personnel was included in the analysis. The study included all eleven elementary schools with six schools

assigned to the Treatment group and the remaining five assigned to the Quasi-control group. Due to a limited time availability of computers used for this study, schools were paired for instruction on a geographic basis; therefore it was not possible to randomly assign schools to groups. An effort was made, however, to divide the town and rural schools into groups on a fairly even basis. The Treatment group included one town elementary school, one primary school and four rural elementary schools. The Quasi-control group included three town elementary schools and three rural schools. Table 1 shows the number of elementary teachers who participated in the two groups.

Definition of Terms

Computer anxiety. A general feeling of apprehension or fear when operating a computer. A review of literature revealed several references to computer anxiety. Common terms included computer fear (Bacon, 1983), fear of automation (Everson and Tobias, 1978), computer phobia (Heydinger, 1978), technological anxiety (Knight, 1979), chipophobia (Payne, 1983), computer tension (Rottier, 1982), technophobia

Table 1

Number of Elementary Teachers

in Treatment and Quasi-control Groups

Treatment		Quasi-control	
School	# Teachers	School	# Teachers
A (Rural)	9	G (Town)	15
B (Rural)	4	H (Town)	8
C (Rural)	15	I (Town)	12
D (Rural)	9	J (Rural)	15
E (Town)	22	K (Rural)	7
F (Town)	21		
Total	80	Total	57

(Grossnickle and Laird, 1983), and micro-anxiety (Widmer, 1983). Throughout the present study the term "computer anxiety" was used as the general term.

Computer Knowledge. Knowledge is defined as the fact or state of knowing or familiarity gained by experience. Computer knowledge was determined by the Minnesota Computer Literacy and Awareness Assessment.

LOGO Knowledge. LOGO knowledge was determined by the administration of a criterion-type test on LOGO terms and procedures.

Hands-On. Participants in the Hands-On Workshops were given instruction and demonstration and were required to use a computer during all workshop sessions.

Treatment Design

One of the best vehicles for offering instruction for teachers is the in-service workshop. In this study the treatment was a three-session in-service workshop the design of which was based on the following principles which have been derived from the literature:

Principles

Create a non-threatening atmosphere. The literature concerning computer anxiety recommended the introduction of computers in a supportive environment. Game-playing and equally enjoyable activities provide positive initial interactions with computers which may encourage further investigation of the computer's potential (Knight, 1979; Everson, 1979; Widmer and Parker, 1983; and Heydinger, 1978).

Explain the computer hardware functions. The explanation of computer hardware components and the interaction between them is an important factor in the introduction to computer use. An understanding of the relationship of these components is essential for the participants' sense of control over the computer (Widmer and Parker, 1983; and Payne, 1983).

Pair participants into partner groups. Workshop participants gain a feeling of teamwork and assistance if they are allowed to work with partners (Knight, 1979; Widmer and Parker, 1983; and Payne, 1983).

Offer practical activities. Instructionally appropriate activities which can be easily adapted for the teachers' classroom needs are recommended by

successful workshop instructors (Widmer and Parker, 1983; Payne, 1983; Heller, 1982; and Grossnickle and Laird, 1983).

Provide hands-on experience. The opportunity to interact with the computer was the most consistently supported requirement in the workshop literature (Filliman, 1983; Grossnickle and Laird, 1983; McMeen, 1984; Knight, 1979; Widmer and Parker, 1983; and Payne, 1983).

Encourage experimentation. Experimentation reassures workshop participants that mistakes do not damage the computers (Widmer and Parker, 1983).

Utilize graphics. Simple graphics allow an enjoyable introduction to computer use. Mistakes in the graphics mode are much more interesting than in the text mode (Widmer and Parker, 1983).

Provide teacher feedback. Teacher feedback, ranked as a major component of in-service education, simply provides an evaluation of teacher performance. Constructive feedback creates the opportunity for improving or revising workshop skills (Olivero, 1970; Fisher, 1971; and Edelfelt and Lawrence, 1975).

Suggest appropriate follow-up materials.

Post-workshop activities and suggestions for appropriate materials are helpful follow-up recommendations (Widmer and Parker, 1983).

Provide an available resource person. A computer resource person should be available to offer any needed assistance following the workshops (Rubin, 1979).

Workshop Content

A nonthreatening introduction to LOGO language was proposed. Maddux (1984) explained that LOGO was developed by Papert and his associates at the Artificial Intelligence Laboratory at the Massachusetts Institute of Technology. LOGO is unique in that it is based upon educational theory. Much of the early educational software packages were criticized because of their poor quality. This is partially due to the fact that the software writers had been computer scientists who may have had solid programming skills but little knowledge about child development. Although Papert was a computer scientist, he spent five years in Geneva studying child development with Jean Piaget. Through LOGO, Papert attempted to combine the computer's capabilities with

Piaget's ideas about the child's ability to think and learn.

LOGO was chosen for these workshops for several reasons: First, middle school computer literacy classes in Montgomery County utilize BASIC language. In order to provide a meaningful sequence of computer experiences, it was important to offer something more foundational at the elementary level. Secondly, LOGO involves skills which are quickly and easily acquired. Because of the simplicity of operation, teachers should be able to incorporate LOGO into their classroom instruction soon after the workshop sessions. The third reason was that LOGO is less symbolic than many other languages. It contains many simple commands which reduces the need for extensive programming.

It was expected that these positive aspects of LOGO would assist the workshop participants in gaining some sense of control over computers. It was hoped that once teachers were convinced of the ease with which LOGO could be utilized, any existing computer anxiety would be reduced and they would be encouraged to further investigate computer use possibilities.

The workshops were organized into three sessions which included instruction, demonstration and hands-on

experimentation involving the LOGO skills listed in the workshop outlines included in Appendix B.

Although teachers may realize their need for computer training, they are often hesitant to include additional activities in already-crowded schedules. In order to offer some compensation for attending the workshops, teachers were given a one hour, non-college credit for the in-service. A proposal for awarding credit was submitted to and approved by the Virginia State Department of Education.

Workshop Process

Arrangements were made to borrow ten Apple IIe computers from the Montgomery County Gifted and Talented program for workshop use. On December 3, 6 and 13, workshop sessions were held in the A School amphitheater area for the A and B School faculties. The C School library was the site for the C and D School groups on January 3, 7 and 14. The computer lab was then moved to the E School library for separate workshops for large E and F School faculties. The E School faculty met on January 23, 28 and 30 and the F School teachers met on January 24, 29 and 31.

Each workshop included three two-hour sessions which were held from 3:15 to 5:15 p.m. immediately following regular school days. Commuting time for teachers from the school not housing computers ranged from 5 to 10 minutes.

The workshop design was based upon principles derived from the literature concerning computer instruction for teachers. The implementation of these principles was verified by observers at each workshop session. (See Appendix C).

In an attempt to meet the criteria set forth in the literature, LOGO instruction was given during the workshop sessions accompanied by visual aids, hands-on practice, individual assistance and reinforcement of computer manipulation skills in an effort to create a learning atmosphere that was both stimulating and non-threatening. Teachers were required to work in partner groups of two or three depending on computer availability. Computer hardware components and their interrelationships were explained and demonstrated. Utilizing the graphic capabilities of LOGO language, teachers were exposed to activities which could be easily modified to suit the ages and abilities of their students. Experimentation with LOGO was encouraged

throughout the workshop sessions and teacher feedback was continually offered. A description of the workshop sessions was developed by observers and was written independently of the investigator. A copy of this document is included in Appendix C.

All elementary principals had been encouraged to purchase copies of Learning with Apple LOGO by Watt and The Turtle Sourcebook by Bearden, Martin & Muller for use as follow-up resource books. The teachers were encouraged to contact the workshop instructor at the Montgomery County Central Office at any time they had questions following the workshop sessions.

Workshop Implementation

The six schools in the Treatment group were given a three-session in-service workshop. Each workshop included from 16 to 27 participants. Some workshops were held for two faculties simultaneously, depending upon faculty size and school location. One computer was made available for each partner team of two to three members. The entire workshop was based upon hands-on activities which allowed continuous interaction with computers.

The five schools in the Quasi-control group did not receive any computer instruction until all post-test measurements had been collected. Because these schools were used for Quasi-control purposes, post-workshop measures were not relevant to the study and consequently were not administered after instruction.

Measurement

Three instruments were used to collect baseline information concerning anxiety, computer knowledge and experience: a Computer Background Information survey, the Trait section of the State-Trait Anxiety Inventory and Part II of the Computer Literacy and Awareness Assessment (See Appendix D). During the introduction to the first workshop session, participants were asked to complete the State portion of the State-Trait Anxiety Inventory, relating their responses directly to their immediate feelings concerning computers. For the Treatment group only, the State section was again completed at the conclusion of the workshop sessions. Following the workshop treatment, an affective measurement was provided by Part I of the Computer Literacy and Awareness Assessment and a LOGO quiz was

used with the Treatment group to determine how well the workshop participants had grasped key LOGO commands. It should be noted that the Quasi-control group did receive workshop treatment; however, in order for the Quasi-control group to be utilized as a no-treatment group, post-test measures were administered to this group prior to receiving instruction. Table 2 outlines the test administration.

The three pre-workshop measurements were taken at all schools from November 12-27 during a workshop introduction session following regular school days. The Computer Background Information survey was used to gather demographic information concerning the teachers' computer background and experience. The Trait section (Form Y-2) of the State-Trait Anxiety Inventory measured the teachers' general levels of anxiety. Spielberger (1983) described trait anxiety as "relatively stable individual differences in anxiety-proneness, that is, to differences between people in the tendency to perceive stressful situations as dangerous or threatening." The test-retest correlations for the T-Anxiety scale were reasonably high, ranging from .73 to .86 for the six subgroups tested.

Table 2

Test Administration

A. Baseline information I. Computer Background Information II. State-Trait Anxiety Inventory (Trait) III. Computer Literacy and Awareness Assessment (Part II -- Computer Literacy)
B. Pre-tests I. State-Trait Anxiety Inventory (State)
C. Post-tests I. Computer Literacy and Awareness Assessment (Part I -- Affective) II. State-Trait Anxiety Inventory (State) (Treatment group only) III. LOGO quiz

The Minnesota Computer Literacy and Awareness Assessment designed for assessing computer literacy of secondary students was used. This test was standardized using 2,535 secondary students in May 1979. It was rewritten for adaption to the junior high level and administered to 3,615 8th graders in November 1979. The Assessment is composed of 120 items and is divided into three parts: an affective assessment (items 1-30), a cognitive or Computer Literacy test (items 31-83) and a background survey (items 84-120). Part II (Computer Literacy) of the Assessment provided a measure of the participants' general computer knowledge. This instrument serves to construct a baseline description of teacher computer knowledge. As such, it provided a basis from which differences were determined between the Treatment and Quasi-control groups. Part II consists of 50 items which are either true-false, multiple choice or "I don't know." The five dimensions of the cognitive test included: 1) hardware, 2) software, 3) applications, 4) impact, and 5) programming. Table 3 shows the alpha reliability for the cognitive subtests as computed by the Minnesota Educational Computing Consortium. The pre-workshop testing session required an average of twenty-five minutes.

Table 3

Alpha Reliability for the Cognitive Subtests

Minnesota Computer Literacy and Awareness Assessment

Form 8 Part II

	Subtest	# Items	Alpha Reliability
1.	Hardware	10	.51
2.	Software	7	.54
3.	Applications	15	.64
4.	Impact	13	.58
5.	Programming	5	.39
	Composite	50	.84

At the beginning of each workshop, the State portion (Form Y-1) of the State-Trait Anxiety Inventory (See Appendix E) measured the participant's present level of anxiety specifically concerning computers. Spielberger (1983) described state anxiety which "refers to a palpable reaction or process taking place at a given time and level of intensity." The stability coefficients for the S-Anxiety scale were relatively low, ranging from .16 to .62 with a median reliability coefficient of .33. Alpha reliability coefficients are higher for the A-State scale when it is given under psychologically stressful conditions. Item-remainder correlation coefficients are also higher when the scale is administered under stressful conditions.

In addition to measurements made according to the Test Administration schedule, two behavioral measures were used with the Treatment group only to provide descriptive information to document workshop results. During the second workshop, Treatment group participants were given a copy of the Virginia Tech emblem (See Appendix F) and were asked to create an Apple LOGO program which would reproduce it. Teachers were also requested to document their school computer use time on a Computer Use Form (See Appendix G) which was placed in

each school. These products and logs were descriptively analyzed and reported in Chapter IV.

For the Treatment group, three post-workshop measures were taken (See Appendix H). The State portion (Form Y-1) of the State-Trait Anxiety Inventory was administered for the second time. A comparison of the pre- and post-workshop measures indicated the effectiveness of the workshop sessions in reducing the participants' levels of anxiety. The second post-workshop measure was Part I (The Affective Assessment) of the Minnesota Computer Literacy and Awareness Assessment. The affective assessment contained 20 items to which each teacher was asked to strongly disagree, disagree, be undecided, agree, or strongly agree. This section focused upon positive attitudes toward computers and broke down into the following categories: 1) enjoyment, 2) anxiety, 3) efficacy, and 4) educational computer support. Table 4 shows the alpha reliability for the affective scales.

The third post-workshop measure was a criterion-type test concerning LOGO terms and procedures. The LOGO quiz was specificially designed to test the workshop participants' knowledge of LOGO commands. In order to determine the reliability of this

Table 4

Alpha Reliability for the Affective Scales

Minnesota Computer Literacy and Awareness Assessment

Form 8 Part I

	Scale	Alpha Reliability
1.	Enjoyment	.81
2.	Anxiety	.64
3.	Efficacy	.60
4.	Educational Computer Support	.66

instrument, it was administered to eighteen adults who had received a two-hour LOGO demonstration and a one-hour hands-on session. The instructors of the LOGO session were provided a copy of the LOGO quiz and were requested to incorporate the 20 commands within the two-hour demonstration, thereby establishing content validity of the instrument. Eighteen other adults who had no previous LOGO experience also took the test. A combination of these two groups resulted in an alpha coefficient of .90.

An alpha level of .05 was used as a basis for determining significance on all statistical treatments.

CHAPTER IV

Results

Computer anxiety has become a legitimate concern in education. While school systems are supporting technology by increasing the availability of computers, they are failing to offer appropriate teacher training. The workshop literature consistently supported careful introductory periods and hands-on computer opportunities for teachers, in order to combat their reluctance toward computer use.

Workshops designed with these goals were offered to elementary teachers in Montgomery County, Virginia. One hundred fifty-three elementary school personnel participated in the workshops. Because the literature review was based upon computer anxiety as it relates specifically to teachers, data were not compiled for non-teaching staff which included principals, secretaries and librarians. Deletion of these personnel resulted in a participant total of 137 which were divided into Treatment and Quasi-control groups by a pairing of schools described on page 44.

Pre-workshop Measurements

Both the Treatment and Quasi-control groups completed the Computer Background Information survey, the Trait section of the Spielberger's State Trait Anxiety Inventory and Part II of the Minnesota Computer Literacy and Awareness Assessment prior to the workshop sessions. Discussion of each measurement follows.

Computer Background Information

The 12 questions in the Computer Background Information survey were used to ascertain the teachers' educational and computer experience levels. Questions 1 thru 4 required multiple choice answers concerning the teacher's level of education, grade taught, number of years of teaching experience and age. Questions 5 thru 8 referred to the teacher's personal computer use: number of computer classes, course location, possession of a home computer and number of computer hours per week. Questions 9 thru 11 dealt with student computer use and Question 12 requested the teacher's evaluation of his/her typing skill level. A copy of the survey in Appendix I includes the percentages of response, listed by Treatment and Quasi-control groups.

A Chi-square was used to test the independence of the groups, noting especially the number of computer courses, whether or not the teacher had access to a home computer, and level of classroom computer use. The only comparison which revealed a significant difference between groups was in regard to the number of computer courses. Only 22% of the Treatment group had previous computer training while the Quasi-control group reported that 51.8% had taken at least one computer course. A Chi-square coefficient of 18.21 ($p < .05$) was found. This indicates that the groups were not independent in relation to number of computer courses completed prior to the study.

Trait Anxiety

The Trait section of the Spielberger State Trait Anxiety Inventory which requires teachers to respond to 20 statements indicating "how they generally feel," yielded individual Trait Anxiety scores. The Treatment group scores ranged from 20 to 62 with a mean of 37.33 and a standard deviation of 8.74. The Quasi-control groups scores ranged from 21 to 52 with a mean of 35.32 and a standard deviation of 8.00. A t-test for independence of groups resulted in failure to reject the

assumption of statistical equivalency between groups, t = 1.37, df = 135, $p > .05$.

Computer Literacy

The Computer Literacy section (Part II) of the Minnesota Computer Literacy and Awareness Assessment contains 50 questions relating to hardware, software, applications, impact and programming. Working with a Treatment group mean of 35.69 with a range of 12 to 50 and a standard deviation of 8.21 and a Quasi-control group mean of 38.28, ranging from 20 to 49 with a standard deviation of 6.64, a t-test for independence of groups yielded a significant difference between groups, $t = -1.97$, df = 135, $p < .05$.

The Computer Literacy portion breaks down into five dimensions: hardware, software, applications, impact and programming. The overall percentage of correct responses was high throughout the first four dimensions particularly within the areas of applications and impact. The fifth area involving choices of output for programs resulted in small percentages of correct responses with large percentages of "I don't know" answers as the example programs increased in difficulty.

Although a t-test of independence of groups yielded significant differences at the .05 level for the overall test, a Chi-square test of independence within the five dimensions of hardware, software, applications, impact and programming reported no significant differences between Treatment and Quasi-control group responses, $p > .05$.

The complete Computer Literacy section is included in Appendix J and lists percentages of responses for both groups.

State Anxiety

At the beginning of the first workshop session, members of the Treatment group completed the State portion of the Spielberger State Trait Anxiety Inventory, responding specifically to "immediate" attitudes toward computers. The State Anxiety measure administered to the Quasi-control was treated as a pre-test measure. An analysis was made to determine the differences between the pre-test version given the Treatment group and that given the Quasi-control group. Working with a Treatment group mean of 43.16 with a range of 20 to 80 and a standard deviation of 12.54 and

a Quasi-control group mean of 38.28, ranging from 20 to 71 with a standard deviation of 11.63, a t-test of independence of groups yielded a significant difference between groups, $t = 2.31$, $df = 135$, $p < .05$.

Post-workshop Measurements

Measurements taken after Treatment included Part I of the Minnesota Computer Literacy and Awareness Assessment, the State section of the Spielberger State Trait Anxiety Inventory and a LOGO quiz. These instruments were given on a post-test only basis with the exception of the State Anxiety measure which was administered as a pre- and post-test for the Treatment group.

State Anxiety

At the end of the third workshop session, the State section of the State Trait Anxiety Inventory was again completed by the Treatment group in relation to the participants' feelings concerning computers. The group mean was 38.66 with a range of 20 to 68. Working with a pre-workshop mean of 43.16 with a standard deviation of

12.54 and a post-workshop mean of 38.66 with a standard deviation of 12.89, a t-test for independence of groups yielded a $t = 2.85$, $df = 79$, $p < .05$, suggesting that the post-test indicated that computer anxiety had decreased.

Computer Literacy and Awareness Assessment (Part I)

The Affective section (Part I) of the Minnesota Computer Literacy and Awareness Assessment contains 20 positive and negative statements to which teachers responded in regard to attitudes toward computer use. This measure resulted in a Treatment mean score of 77.05 with a range of 47 to 100 and a standard deviation of 10.56. The Quasi-control group mean was 73.12 with a range of 41 to 98 and a standard deviation of 10.90. A t-test for independence of groups revealed a significant difference between groups with the Treatment group reporting more positive attitudes toward computer use, $t = 2.12$, $df = 135$, $p < .05$.

LOGO Quiz

The LOGO quiz included 20 multiple choice questions which dealt specifically with LOGO commands used frequently during the hands-on portion of the workshop sessions. The mean score for the Treatment group participants who had completed their in-service training was 18.73 with a range of 3 to 20 and a standard deviation of 2.31. The mean score for the Quasi-control group participants who had not begun their training was 10.70 with a range of 5 to 18 and a standard deviation of 2.87. A t-test for group independence resulted in a statistically significant difference between groups, t = 18.11, df = 135, $p < .05$. A copy of the quiz included in Appendix K shows percentages of correct responses listed for Treatment and Quasi-control groups.

Crosstabulations

A crosstabulation of scores from Part II (Computer Literacy) of the Minnesota Computer Literacy and Awareness Assessment with pre-workshop State anxiety scores ranked high, medium and low yielded a significant correlation between low and medium State anxiety with

medium and high scores on the Computer Literacy assessment, $r = -.33$, $p < .05$. An identical analysis of the Quasi-control group scores yielded a similar inverse relationship between computer knowledge and computer anxiety, $r = -.37$, $p < .05$. A subsequent crosstabulation of Treatment group post-workshop State anxiety and scores from the LOGO quiz revealed an inverse relationship between computer anxiety and LOGO knowledge, $r = -.25$, $p < .05$.

Behavioral Measures

In order to provide descriptive information of teacher behaviors during the workshops, a performance requirement was made of the teachers and a self-report of school computer use was collected. During the second workshop session, Treatment group participants were given a copy of the Virginia Tech emblem and were asked to create an Apple LOGO program which would reproduce it. A copy of the original emblem and sample reproductions created by teacher groups are included in Appendix F. Teachers were also requested to document their school computer use time on a Computer Use Form (See Appendix G) which was placed in each school. Of

the nine teachers reporting computer use in Schools A and B, the average time was 1 hour and 50 minutes for personal use and 53 minutes for classroom use. Schools B and C submitted reports from 24 teachers who registered an average of 2 hours and 29 minutes for their own use while the classroom use averaged 2 hours and 55 minutes. School E had 21 teachers report an average of 60 minutes per teacher use and six teachers reported classroom use which averaged 2 hours and 10 minutes. Only one teacher listed 15 minutes of personal use during the workshop at School F. This particular period was plagued with inclement weather and several reschedulings of sessions which may explain lack of teacher time for computer use.

Comparison of Trait Anxiety with Scores

Four one-way analyses of variance were used to compare the Treatment group participants' Trait Anxiety scores with State Anxiety, Computer Literacy, Affective and the LOGO quiz scores. The Trait Anxiety scores were ranked from 62 to 20, then divided into High, Medium and Low anxiety groups with 26-27 teachers in each. Difference scores were then calculated between the pre-

and post-workshop State Anxiety measurement and compared across the three levels of anxiety. The group with the highest Trait anxiety had the largest difference scores, $F = 7.15$, $p < .05$. The three levels of Trait anxiety were then compared wih scores from Part II (Computer Literacy) and Part I (Affective) sections of the Computer Literacy and Awareness Assessment and the LOGO quiz. There were no significant differences on the post-tests across the groups created by the three origin levels, $p > .05$. Summary tables outlining the results of these comparisons are included in Appendix L.

CHAPTER V

Conclusions

The computer, once regarded as a mysteriously powerful information processing giant, has invaded the home, the office and the classroom in a miniaturized form: the microcomputer. Although it resembles a television set (which was also once considered a tremendous technological advancement), the microcomputer represents power, speed and computational ability far exceeding any machine previously available for everyday use. While some individuals have been quick to explore the computer's potential, others have reacted in fear; such reaction has been termed "computer anxiety."

Although educators have often been expected to be pacesetters in our society, they have not been immune to computer anxiety. The information collected for this study suggests that teachers often experience anxiety and show reluctance to utilize computers in the classroom; those choosing to use computers are often doing so without previous training. It was also noted that student computer use is often unsupervised. The literature further suggests that computer anxiety may

prevent teachers from seeking the computer training needed for meaningful computer utilization. Because of the need to reduce teacher anxiety toward computer use and to provide effective training for meaningful computer utilization, this study investigated the effectiveness of workshops which were based upon principles derived from the literature on in-service training and were designed to reduce computer anxiety while at the same time increase computer knowledge.

Conclusions

The workshops designed according to principles derived from the in-service literature and implemented as a treatment in this study were effective in terms of producing a knowledge gain, a decrease in anxiety and more positive attitudes toward technology. In order to assess the increase of computer knowledge, a LOGO quiz was given to the Quasi-control group before training and to the Treatment group after training. The significantly higher scores of the Treatment group indicate an increase in computer knowledge through the workshop experience. A comparison of the Treatment group pre- and post-workshop State Anxiety scores

suggests a significant reduction of anxiety during the workshop period. On Part I of the Computer Literacy and Awareness Assessment, the Treatment group showed a significantly higher positive attitude toward computer use.

Results of the study are generally supportive of an inverse relationship between teacher computer knowledge and teacher computer anxiety. Several findings of the study support this conclusion. Teachers undergoing the treatment workshops were found on the LOGO post-test to have significantly greater computer knowledge in this area than the Quasi-control group. At the same time, based on the pre- and post-test State Anxiety measures of the Treatment group, computer anxiety was reduced.

A comparison of the Computer Background Information surveys yielded the finding that the Quasi-control group had more previous computer training via courses than did the Treatment group. Also, a comparison of Treatment and Quasi-control group scores on the Computer Literacy section of the Computer Literacy and Awareness Assessment resulted in significant differences between the two groups with the Quasi-control group scoring higher than the Treatment group. Furthermore, when administered to the Quasi-control group, the State

Anxiety measure revealed a lower anxiety level for that group than the Treatment group reported after training. These differences were not anticipated in the study design, but the findings lend support to the conclusion that computer knowledge increased during the treatment workshops.

When considered together, the findings relative to computer knowledge and anxiety reduction can be interpreted as supporting the conclusion of an inverse relationship between computer knowledge and computer anxiety. Within the affective scale on Part I (the Affective section) of the Computer Literacy and Awareness Assessment, the Treatment group ranked the value "technology" higher than the Quasi-control group. Comparisons of affective scales between groups can be interpreted as suggesting that the treatment workshop increased favorable feelings toward computer use. This is consistent with the teacher computer workshop literature reviewed in Chapter II. Given that the Quasi-control group had more prior computer training than the Treatment group which training appeared to yield knowledge and anxiety levels comparable to those of the Treatment group after the workshops, it was reasonable, therefore, to expect similar attitudes

toward computer use. Since this was not the case, it is plausible to suggest that the treatment workshops have the potential to yield more positive attitudes toward computer use than would be the case with conventional training. This finding could also be explained by a recency of treatment effect.

The null hypothesis stated that there would be no difference in the computer knowledge and computer anxiety of teachers who receive the workshop instruction and teachers who do not receive the workshop instruction. A comparison of computer anxiety and computer knowledge for the Treatment group before and after training supports rejection of the null hypothesis. Statistical differences were noted in the pre- and post-workshop State Anxiety scores, indicating that computer anxiety reduction was due to training. The comparison of LOGO knowledge of the Quasi-control group before training with the LOGO knowledge of the Treatment group after training resulted in significant differences in scores. The LOGO measurement suggested that the training did produce teacher computer knowledge.

It is not possible to have complete confidence in this rejection because the Quasi-control group initially

reported a lower degree of anxiety and higher scores on the computer knowledge measure. The prior training reported by the Quasi-control group confounded the possibility of equivalency of groups for the experimental reasons set forth in this study. This problem was not anticipated and it makes comparisons between the Treatment group and Quasi-control group difficult. These results do, however, lend credence to the idea that computer training is accompanied by lower anxiety.

The study results support the in-service training and computer anxiety literature reviewed in Chapter II. The findings promote in-service workshops which focus upon increasing computer awareness while helping to alleviate computer anxiety as suggested by Payne (1983). Allowing teachers to work with partners (Knight, 1979; Widmer and Parker, 1983; and Payne, 1983) in a non-threatening atmosphere (Knight, 1979; Everson, 1979; Widmer and Parker, 1983; and Heydinger, 1978) seemed to create an effective learning environment. The provision of practical hands-on computer activities (Filliman, 1983; Grossnickle and Laird, 1983; McMeen, 1984; Knight, 1979; Widmer and Parker, 1983; and Payne, 1983) and consistent positive feedback (Allen, 1971) were vital to

the alleviation of computer anxiety. Although Knight (1979) supported game-playing as the most effective method of reducing computer anxiety, this study suggests that computer language instruction which can be adapted across grade levels may be an appropriate vehicle for teacher training.

It is important to take note of one further aspect of the methodology. As with many developmental studies, verification that a training model was, in fact, implemented as designed is difficult to show. For this study, a method of auditing the implementation of the workshop was used. Trained observers recorded the workshop activities throughout all Treatment workshops. This process provided a useful way both to enhance the descriptive portions of this document as well as to provide verification that the model implementation was according to design. The workshop description included in Appendix C reflects both supportive and nonsupportive evidence which was gathered, summarized and written by the observers independent of the researcher.

Limitations of the Study

This study was limited by the lack of equivalency of groups. Due to a limited time availability of computers, random assignment was not possible. Although the town and rural schools were distributed on a fairly even basis, the Quasi-control group had more prior computer experience. This was not known prior to the time the grouping processing occurred. It is difficult to conclude that the Quasi-control group's previous experience accounted for a significantly lower degree of computer anxiety as measured by the State Trait Anxiety Inventory. These teachers reported lower anxiety levels before training than the Treatment group after training. These inconsistencies made comparisons of the groups difficult.

Recommendations

Due to the differences between the Treatment and Quasi-control groups which occurred because of the school pairing process utilized, clearcut inferences were difficult to draw in this study. In any similar study, it would be advisable to more completely control

the sample selection in order to assure equivalency in groups. A computer background survey is extremely useful in obtaining information about study participants, but the instrument should be conducted and analyzed prior to assignment of groups.

Based on the results of the study, the researcher believes that workshops designed according to these principles will provide a useful model for school systems desiring to increase teacher computer knowledge in an effort to reduce teacher computer anxiety. However, the workshop time should probably be lengthened. Six hours of instruction provided merely an introduction to LOGO. An extended period of time would allow mastery of a particular language and increase the comfort with which teachers interact with computers.

The literature draws attention to the fact that teachers exhibit reluctance in seeking computer instruction while simultaneously encouraging students to continue to grow and enlarge their experience. Computer anxiety studies should be expanded in order to study the effects upon students whose classroom teachers are identified as computer anxious.

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APPENDICES

APPENDIX A

EDUCATIONAL INNOVATION SURVEY

EDUCATIONAL INNOVATION SURVEY

1. Having a computer in my room would improve my instruction.

2. I can think of some great ways to use the computer for teaching in my subject area.

3. If a student wanted to do a project for my class that involved recording a video tape, I would strongly encourage him/her to do it.

4. My subject area is not appropriate for using the computer.

5. I worry about the bad consequences of putting television in schools.

6. I believe innovation will help keep alive what is best in education.

7. I believe that more money should be spent on television equipment in schools.

8. When there is a staff of well prepared teachers in a school, films are not necessary.

9. Any teacher should be able to make use of photography in the classroom.

10. I don't plan to get involved in educational innovation.

11. Given the choice between teaching a subject through a traditional method or on a computer program, I would probably choose the traditional method.

12. I believe film projectors are too complicated for the average teacher to run.

13. Photography in schools contributed to a sound education.

14. A computer in my room would reduce discipline problems.

15. My use of computers has been very limited.

16. Films detract from the quality of instruction.

17. If there is a computer in my classroom, I will suggest it be placed in another room where it could be put to better use.

18. Teachers should be willing to give any new teaching method a try.

19. If there were no overhead projectors in my school, I would request that some be obtained.

20. I believe that filmstrips have been used successfully in many schools.

21. Television can be used for instruction in many subject areas.

22. I look forward to the time when computers are in all classrooms.

23. A teacher should not be expected to accept new media in the classroom.

24. If available, I would choose films over other forms of instruction for some of my teaching.

25. I doubt if I will use the computer in my teaching.

26. I think the taxpayers would see a record player in my classroom as a waste of their money.

27. I believe that, in general, non-print media, (films, video tapes, cassettes, etc.) are too expensive for schools to buy.

28. My undergraduate coursework has made me knowledgable of television in schools.

29. Few schools have successfully used non-print media in instruction.

30. I am not prepared to make use of the computer in my teaching.

APPENDIX B

WORKSHOP SESSION OUTLINES

WORKSHOP SESSION I

---

1) To boot LOGO:

A) Place Apple LOGO disk in drive
B) Close disk drive door
C) Turn on monitor and computer
D) When message appears:

PRESS THE RETURN KEY TO BEGIN

IF YOU HAVE YOUR OWN FILE DISKETTE,
INSERT IT NOW, THEN PRESS RETURN

E) Remove Apple LOGO disk from drive
F) Place your disk in drive and hit RETURN
G) When message appears:

WELCOME TO LOGO
?

H) Type ST for Show Turtle

---

2) Commands to move Turtle:

FD = forward
BK = back
RT = right
LT = left
ST = show turtle
HT = hide turtle
HOME = takes turtle to home position
PU = pen up
PD = pen down
PE = pen erase
CS = clear screen

---

3) Error messages:

Type: FD60
RT LOTS
FD 999999

---

4) Play Ant Maze

---

5) Defining a procedure:

```
TO SQUARE                TO SQUARE
>FD 30                   >REPEAT 4 [FD 30 RT 90]
>RT 90                   >END
>FD 30          OR
>RT 90
>FD 30
>RT 90
>FD 30
>RT 90
>END
```

---

6) EDIT procedures:

```
ED "TRASH

        CTRL N = next line
        CTRL P = previous line
        CTRL F = forward
        CTRL B = back
        CTRL D = delete
        CTRL C = completed edit
```

---

7) CTRL G = "GET OUT!" = stops turtle on his path!

---

8) Assignments:

Read Pages 3-16 in Turtle's Sourcebook:
"The Tortoise and the Hare: A Computerized Update of the Ageless Fable" and
"Technological Turtle Tools"

Construct: a square
a rectangle
a triangle

WORKSHOP SESSION II

---

9) Square procedures:

A)
```
TO SQUARE
>REPEAT 4 [FD 30 RT 90]
>END
```

B)
```
TO SUPERSQUARE
>REPEAT 8 [SQUARE RT 45]
>END
```

C)
```
TO STARSQUARE
>REPEAT 12 [SQUARE RT ___ ]
>END
```

D)
```
TO MEGASQUARE
>REPEAT 36 [SQUARE RT ___ ]
>END
```

E)
```
TO SUNSHINE
>PU
>FD 70
>LT 90
>FD 80
>RT 90
>PD
>MEGASQUARE
>END
```

F)
```
SAVE "SQUARES
```

---

10) More LOGO commands:

```
ERALL  = erases all procedures in memory
LOAD "PROGRAM = loads procedure from disk
POTS   = print out titles
POPS   = print out procedures
CTRL L = full screen
CTRL S = split screen
CTRL T = text screen
```

---

11) Procedures and Subprocedures:

(taken from LEARNING WITH APPLE LOGO)

```
TO SMALLBOX
REPEAT 4 [FD 30 RT 90]
END

TO BIGBOX
REPEAT 4 [FD 60 RT 90]
END

TO MOVEOVER
RIGHT 90
FORWARD 60
LEFT 90
END

TO MOVEBACK
LEFT 90
FORWARD 50
RIGHT 90
END

TO WHEELS
RIGHT 90
RCIRCLE 5
FD 60
RCIRCLE 5
BK 75
LT 90
END
```

```
TO TRUCK
BIGBOX
MOVEOVER
SMALLBOX
MOVEBACK
RT 90
FD 5
LT 90
WHEELS
END
```

---

12) LOGO PRACTICE EXERCISES:

A. Draw a large square and a small square.

B. Draw a triangle.

C. Draw a house using a square and a triangle.

D. Draw your initials with no connecting lines
(HINT: Use PU = pen up and PD = pen down)

E. Practice editing by loading TRASH

```
LOAD "TRASH

CTRL N = next line
CTRL P = previous line
CTRL F = forward
CTRL B = back
CTRL D = delete
CTRL C = completed edit

SAVE "RECYCLE
```

F. Write a procedure that fills the screen with shapes.

G. Write a procedure that draws a stick person.

---

13) Assignment:

Write a procedure that reproduces the VT logo.

WORKSHOP SESSION III

==========

14) SHOW AND TELL

==========

15) Learning With Apple LOGO procedures disk:

A) SHOOT

1. BOOT LOGO
2. Remove disk from drive
3. Place LWAL PROCEDURES DISK in drive
4. Type CATALOG
5. Type ERALL
6. Type LOAD "SHOOT (This may take a while . . .)
7. Type START
8. Give directions for turtle to aim at target
9. Type SHOOT
10. If you wish to play again, type START

==========

B) QUICKDRAW

1. Type ERALL
2. Type LOAD "QUICKDRAW
3. Type QD
4. Without hitting the RETURN, use:

   F = forward 20 steps
   B = back 20 steps
   R = right 30 degrees
   L = left 30 degrees

5. To name the picture, type E
6. Type in a name and hit RETURN
7. Type CS to clear screen
8. Type RD :Picturename

   (Quickdraw will reproduce the picture)

==========

==========

C) Circles and arcs

1. Type ERALL

2. Type LOAD "CIRCLES

3. Try: RCIRCLE 30
LCIRCLE 60
RARC 70
LARC 20

4.

```
TO SNAKE
RARC 20
LARC 20
RARC 20
LARC 20
END
```

==========

16) Recursion:

(taken from LEARNING WITH APPLE LOGO)

A)

```
TO SUN
SNAKE
RIGHT 160
SUN
END
```

B)

```
TO FLOWER
TRIANGLE          (LOGO will say, "I
RIGHT 60           don't know how to
FLOWER             TRIANGLE)
END
```

C)

```
TO SILLY
FORWARD 50
LEFT 90
FORWARD 20
LEFT 120
FORWARD 30
END
```

D)

```
TO SILLYONE
SILLY
SILLYONE
END
```

E)

```
TO SILLYTWO
SILLY
RIGHT 60
BACK 50
SILLYTWO
END
```

==========

17) Variables:

A)

```
TO SQUARE :SIZE
REPEAT 4 [FD :SIZE RT 90]
END
```

B)

```
TO STAR5 :SIZE                    Try: STAR5 135
REPEAT 5 [FD :SIZE RT 144]             STAR5 144
END                                    STAR5 160
```

C)

```
TO SPINSQUARES :ANGLE             Try: SPINSQUARES 144
SQUARE 50
RIGHT :ANGLE
SPINSQUARES :ANGLE
END
```

D)

```
TO STARS :ANGLE                   Try:  STARS 135
FORWARD 50                              STARS 144
RIGHT :ANGLE                            STARS 150
STARS :ANGLE                            STARS 160
END
```

E)

```
TO STARS2 :SIZE :ANGLE            Try: STARS2 50 144
FORWARD :SIZE                          STARS2 75 144
RIGHT :ANGLE                           STARS2 50 135
STARS2 :SIZE: ANGLE                    STARS2 20 135
END
```

==========

18) Color:

```
SETBG 0 = BLACK
SETBG 1 = WHITE
SETBG 2 = GREEN
SETBG 3 = VIOLET
SETBG 4 = ORANGE
SETBG 5 = BLUE

SETPC   = Set pen color
```

APPENDIX C

WORKSHOP DESCRIPTION BY OBSERVERS

Description of Workshops

As a means of independent verification of the treatment phase of the study "The Effects of In-Service Workshops on Computer Anxiety", a separate quasi-ethnographic study was conducted to describe the workshop training sessions of the treatment group. This study was conducted by four graduate students in education, working with the Chairman of the Dissertation Committee and a faculty specialist in ethnographic research in education. With the exception of the initial meeting of observers, no input from the researcher has been considered in this analysis.

At the beginning of this study, the four observers were given a short orientation to the purpose of the study and a list of the ten principles which were the basis for the evaluation of the treatment sessions. Each observer was then assigned to one of the four treatment groups, and observed and reported data for all three workshop sessions of that group. After the completion of all treatment sessions for all groups, the observers met several times and compiled the data reported in this document.

Each workshop included three sessions held after school on three days during a ten day period. The participants were

teachers from one school or two neighboring schools who volunteered to participate in the project.

Topics for session one were operation of a computer, use of disks, introduction to Logo, basic Logo commands, and editing. Session two included additional Logo commands, Logo procedures, and disk operations. The topics for session three were more Logo procedures and variables in procedures.

Instruction was divided into two parts. The first part of each session was lecture by the researcher. The second part consisted of hands-on laboratory activities monitored by the researcher. Apple IIe microcomputers were provided and participants worked in groups of two or three. Participants were tested at the beginning of the first session, and at the end of the third session.

To organize the data, the principles were divided by the observation team into three categories according to the inference required of the observers. Those principles judged to be low-inference were those which were clearly defined and required only a "yes or no" evaluation. These included (2) Explain the computer hardware functions, (3) Pair participants into partner groups, (7) Utilize graphics, and (10) Provide an available resource person. While there were some questions as to the definitions of these principles (to be discussed later), once agreement was reached on a common

interpretation, each of these principles was judged to have been followed in the sessions.

The second category of principles consisted of those which required moderate inference from the observers. These were considered moderate inference because they contained terms which could be interpreted in different ways. Principles considered in this category were (4) Offer practical activities, (5) Provide ample hands-on experience, and (9) Suggest appropriate follow-up materials. Individual observers made judgements as to what was practical, ample, and appropriate in this setting. During the post-treatment meetings of observers, agreement as to the meaning of terms was reached. Concensus among observers was that each of these three principles was followed adequately in the treatment sessions.

The third category of principles was high inference. These were the principles for which the observers had to determine the degree to which the principle was followed, and whether that degree was sufficient. The principles in this category were (1) Create a non-threatening atmosphere, (6) Encourage experimentation, and (8) Provide teacher feedback. in the cases of (6) and (8), it was concluded that the instructor followed these principles to a great degree, and all observers agreed that there was overwhelming positive evidence for them.

The first principle (1) was more difficult to assess. While there was evidence that several participants did feel threatened initially, observers felt that this was not caused by the instructor, but was present a priori because of anticipated workshop content. It was agreed that the instructor made every effort to reduce this anxiety and to make the atmosphere as non-threatening as possible. Thus, the observers concluded that the first principle was followed by the instructor, with varying results. This is further discussed in subsequent paragraphs.

In summary, it was the conclusion of all four observers that all ten principles were followed in the treatment sessions. A more detailed examination of each principle follows. These include descriptions of positive and negative evidence regarding the principle, and direct quotations of some representative comments from observers and participants. The comments are identified as follows: "O1" represents Observer 1; "T1" represents a teacher in workshop 1.

1. Create a non-threatening atmosphere

The first evidence of a non-threatening atmosphere was the existence of positive relationships prior to the workshops. The teachers were instructed in groups consisting of teachers from their schools or from theirs and one other school. Participants knew each other and seemed to be comfortable in the group. All observers noted considerable interaction among teachers throughout the workshops.

Additionally, participants knew the instructor, who is a supervisor in their school system. Her credibility was already established. Teachers did not appear threatened by her, as evidenced by positive rapport observed from the beginning.

The second aspect of creating a non-threatening atmosphere was the choice of Logo as the content. This language is generally judged to be "user friendly", with error messages such as "I don't know how to FW." Participants personalized the Logo turtle, and in several instances referred to it as "he".

The instructor used several games as instructional activities. This seemed to make the participants more relaxed. Participants were asked to move the turtle through a maze using Logo commands. They played a golf game, where Logo commands were used to move the turtle from the tee to

the hole, counting strokes. A game called "Shoot" was included. This involved turning the turtle and moving him forward to a target using Logo commands.

Observers noted that participants seemed involved and interested in the games. The competition appeared to be a positive influence in reducing anxiety.

The third aspect of a non-threatening atmosphere was instructor behavior. Observers agreed that the instructor conducted the workshops in an informal manner. She encouraged the teachers repeatedly and frequently made jokes during her presentations. She distributed materials that included instructions, commands, and examples for reference. She moved among the groups and gave support and encouragement individually.

Teacher behavior during the workshops is the fourth area of concern in determining the atmosphere. All observers noted numerous instances of teacher laughter during hands-on activity. Observers also reported that teachers called for help freely (from instructor or from other participants). Teachers frequently moved from group to group observing and commenting on others' progress.

Principals were involved in the workshops. In one case, the principal provided coffee. In another, the principal was observed in a relaxed posture, with feet propped against the wall, working on the computer.

However, observers noted that some participants appeared quite anxious at the beginning of the sessions. Some participants seemed reluctant during early hands-on activities,and others expressed doubt that they would be able to succeed. This minority of participants appeared to be the most affected during the course of the workshop sessions. Their attitudes seemed quite dynamic: by the end of the workshops, they were willing to attempt activities on the computer and they appeared less anxious.

One source of threat noted by observers was the posttest given to participants at the end of the third workshop session. Some participants expressed anxiety about this test and doubts about their ability. Observers agreed that the atmosphere would have been less threatening if the posttest had not been a part of the workshops. But it was recognized that the posttest was a necessary part of the larger study.

Overall, the conclusion of the observers was that the instructor did create a non-threatening atmosphere. Except for the posttest, which was unavoidable, the instructor's actions were perceived as reducing the threat of the situation.

Comments from observers and participants:

01: "Very good-natured group of teachers. They enjoy each other's company considerably."
02: "Some teachers are walking between groups, making funny comments to friends."

O3: "Teachers laugh a lot, chatter and interact with each other continuously."
O4: "Teachers are relaxed, really seem to be enjoying this."
T1: "Everybody is looking at everybody else's screen--just like the kids!"
T2: "Oh, a game! How exciting!"
T4: "He's (the turtle) already talking back."
T4: "We don't want him (the turtle) to bump his nose."

2. Explain the computer hardware functions

Presentations by instructor included explanation of the function of hardware components. These included the computer itself, the keyboard, the monitor, and the disk drive. The instructor described the difference between main and secondary memory. A disk was taken apart and examined. Commands (SAVE, LOAD, ERALL) were related to hardware. Procedure for booting a disk was discussed. The handout given to all participants included instructions for booting Logo, and also instructions for initializing a disk.

The only question observers raised about this principle was whether the term computer hardware included internal hardware components, such as CPU, RAM, ROM, and chip. These components and their functions were not included in the workshops. The conclusion of the observers was that explanation of these technical functions was not necessary for the level of the workshop participants, and that hardware functions were explained sufficiently for this particular audience.

3. Pair participants into partner groups

All hands-on activities were done in groups. Participants chose partners and groups remained intact through all the sessions. A cooperative atmosphere was noted by observers. Groups alternated typing duties, and all participants contributed. No instances of discord were reported.

The wording of this principle was questioned. "Pair participants into partner groups" seemed to imply that the instructor would assign participants to groups. This was not the case, as the participants chose their own partners. Observers decided that the key idea of this principle was that participants work in groups, and since this was the format, this principle was judged to have been followed.

Comments from observers and participants:

O1: "Teachers work well in a good partnership--thinking, working, sharing."
O2: "Teachers are all contributing, do not see any who are off task."
O4: "Many problems solved internally in group without assistance."
T1: (To one teacher left without a partner) "Come on and join us; it's no fun doing it alone."

4. Offer practical activities

The observers defined "practical activities" in this principle as meaning activities appropriate for use with students in the participants' classrooms.

Since teachers were novice Logo users, most activities included in the workshop would be appropriate in teaching Logo to children. Several references to children were made by instructor. She mentioned additional aids that could be used with children, such as plastic turtles, walnut turtles, and body geometry games. Observers agreed that the instructor presented several practical activities for use in the classroom.

Comments by observers and participants:

O4: Instructor: "Can you imagine what your kids will do when they learn this?"
T4: "The kids will love this!"

5. Provide ample hand-on experience

Observors defined "ample" in this principle to mean as much time as participants wanted to spend. Observer estimates of proportion of time spent in hands-on activity in the sessions ranged from 50% to 75%. Additionally the instructor encouraged participants to work in their own schools, and reminded them that each school had the appropriate materials. She asked them to keep a log of outside use, which she collected at the last session.

Each session consisted of a lecture session followed by hands-on activities. Observers noted in several instances that participants were reluctant to leave the sessions. The

instructor stayed beyond the end of sessions several times to allow groups to continue work. There was one session where participants left a few minutes early because of adverse weather conditions.

Assignments were completed by most groups in allotted time. Several participants took their disks to work at school. Some participants became confident enough to offer assistance to others.

The conclusion was that this principle was followed. Participants had considerable "hands-on" time during the sessions, and virtually unlimited time in their own schools with the same material available.

Comments by Observers and Participants:

01: "Those experiencing success began going around helping others."

04: "Groups became interested in particular projects and there was some branching. All basic activities were completed."

6. Encourage experimentation

Instructor frequently encouraged experimentation. Several times she asked participants to "Play around with this command." Assignments were general, and groups often interpreted them differently and had different results. Some instructions were "(1) Draw your initials... (2) Write a procedure that fills the screen with shapes." All efforts were accepted.

Instructor discussed editing in Session I, and explained that it can easily change mistakes. Projects of groups were varied. Unassigned projects that were completed included a Christmas tree, a 3-D cube, a butterfly, and a face.

Observers agreed that instructor encouraged experimentation to a great degree, and that this principle was followed.

Comments by observers and participants:

O3: Instructor: "Try to make errors and see what happens."
O4: Instructor: "There are many things you can do. This is just a little seed. The more you manipulate it, the better you will understand it."
T1: "My television screen has gone wild."
T2: "Let's see what happens."
T2: "Oh, we'll just do it again."
T2: "Wait, I want to try something. Now everybody add something."
T3: "We don't know what to do. Let's try..."
T4: "It didn't turn out right. Let's edit."

7. Utilize graphics

The workshops used Logo graphics throughout. All lecture, discussion, and activities involved Logo graphics.

8. Provide teacher feedback

Feedback was provided to teachers by instructor in two ways. During hands-on activities observers agreed that she moved around constantly, observing and commenting on pictures. During the final sessions, she displayed projects of groups and listed achievements.

Another source of feedback was the computer itself. Participants observed the results of their efforts immediately and evaluated them.

Observers noted that a great quantity of feedback was provided to teachers. This principle was followed.

Comments by observers and participants:

O2: "Instructor put on sneakers to run from group to group."
O2: "Instructor recapped what each group has accomplished without identifying groups."
O2: "Instructor has 'show and tell' with group disks."
O3: "Instructor gives feedback many times."
O4: "Instructor is encouraging, not interfering."
T1: "We're learning, aren't we? Isn't that amazing?"
T2: "I thought this was going to be hard."
T2: "We did very well on that."
T2: (After entering command) "Yeah, we're right. That's what we want."
T2: "It's not perfect--but I think it's beautiful."
T3: "Oh, that was way off."
T4: "That straightens it out."
T4: "We got it dead center."

9. Suggest appropriate follow-up materials

Observers defined "appropriate materials" as materials that would be useful in improving participants' knowledge and skills, and materials that would be useful in designing instructional activities for students in the participants' classrooms.

Instructor showed and recommended two Logo books to participants. Both books had been previously recommended to principals, and were available in each school.

Observers noted that the two books recommended were not the only materials available and that a list of several references might have been appropriate. It appeared that the instructor had evaluated materials and recommended those that she judged most appropriate. The principle was followed, because materials were suggested.

10. Provide an available resource person

The instructor provided herself as a resource person. As Mathematics/Computer Supervisor for the school system, she was accessable to teachers. She encouraged them to call her.

In one case, the observer did not hear the instructor refer to herself as a resource person. In the other three workshops, observers recorded this reference. The conclusion was that this principle was followed, even though it may not have been clear in one case.

Summary

In general, the concensus of the four observers was that all ten principles were included in the workshop sessions. Because of the inference levels of the principles and the interpretation of the individual observers, some questions were raised. These have been discussed in reference to the particular principles. However, after discussion and clarification, the observers agree that the ten principles were followed.

APPENDIX D

PRE-WORKSHOP MEASUREMENTS

COMPUTER BACKGROUND INFORMATION

1. Level of education:

    1) Bachelors
    2) Masters
    3) PostMasters

2. Grade you are teaching this year:

    1) Kindergarten
    2) First
    3) Second
    4) Third
    5) Fourth
    6) Fifth
    7) Other

3. Years of teaching:

    1) 1-5
    2) 6-10
    3) 11-15
    4) 15-20
    5) 20 plus

4. Age:

    1) 20-30
    2) 31-40
    3) 41-50
    4) 51 plus

5. Number of computer courses:

    1) 0
    2) 1
    3) 2
    4) 3
    5) 4 plus

6. Course location:

   1) Tech
   2) Radford
   3) NRCC
   4) Dealership
   5) Other

7. Do you have a home computer?

   1) Yes
   2) No

8. How many hours per week do you use a computer?

   1) 0
   2) 1-5
   3) 6-10
   4) 10 plus

9. Have you used the school computer in your classroom?

   1) Yes
   2) No

10. Have your students used the computer in a location other than your classroom?

   1) Yes
   2) No

11. Who supervises your students' computer work?

   1) You
   2) Parent volunteer
   3) Another teacher
   4) No one
   5) Other

12. Evaluate your typing skill:

   1) Excellent
   2) Good
   3) Average
   4) Poor

SELF-EVALUATION QUESTIONNAIRE

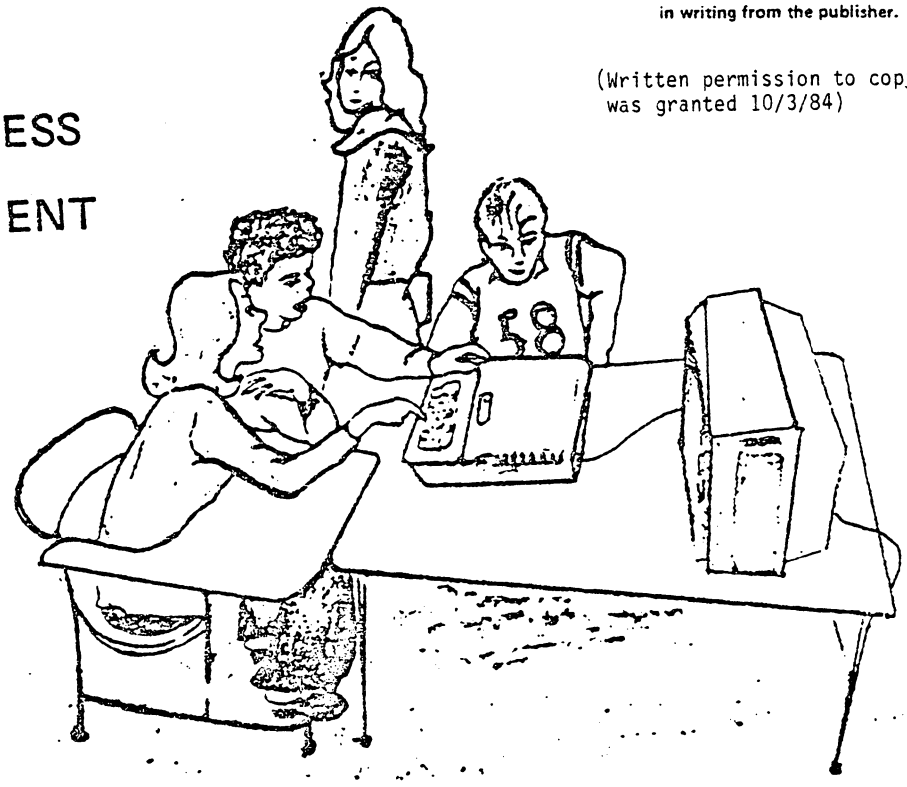
STAI Form Y-2

Name _____ Date _____

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
21. I feel pleasant	①	②	③	④
22. I feel nervous and restless	①	②	③	④
23. I feel satisfied with myself	①	②	③	④
24. I wish I could be as happy as others seem to be	①	②	③	④
25. I feel like a failure	①	②	③	④
26. I feel rested	①	②	③	④
27. I am "calm, cool, and collected"	①	②	③	④
28. I feel that difficulties are piling up so that I cannot overcome them	①	②	③	④
29. I worry too much over something that really doesn't matter	①	②	③	④
30. I am happy	①	②	③	④
31. I have disturbing thoughts	①	②	③	④
32. I lack self-confidence	①	②	③	④
33. I feel secure	①	②	③	④
34. I make decisions easily	①	②	③	④
35. I feel inadequate	①	②	③	④
36. I am content	①	②	③	④
37. Some unimportant thought runs through my mind and bothers me	①	②	③	④
38. I take disappointments so keenly that I can't put them out of my mind	①	②	③	④
39. I am a steady person	①	②	③	④
40. I get in a state of tension or turmoil as I think over my recent concerns and interests	①	②	③	④

MINNESOTA COMPUTER LITERACY and AWARENESS ASSESSMENT



DIRECTIONS: For each of the following questions, choose the best answer and mark it on the answer sheet. If you do not know the answer to a question, do not leave the item blank; mark the letter for "I don't know." Use the "I don't know" response only when you don't even have a guess about the best answer. DO NOT leave any item blank that you attempt; either mark the letter for an answer or "I don't know."

1. Police sometimes use computers to help identify stolen cars.

   1) true
   2) false
   3) I don't know

2. Most nurses give injections by computer.

   1) true
   2) false
   3) I don't know

PAGE 6

3. Computers cannot be used to assist in teaching English grammar.

   1) true
   2) false
   3) I don't know

4. Computers are not really used very much yet except by scientists.

   1) true
   2) false
   3) I don't know

5. Government officials use computers to store and retrieve large amounts of information about citizens.

   1) true
   2) false
   3) I don't know

6. People often use computers to store large amounts of information they wish to use over and over again.

   1) true
   2) false
   3) I don't know

7. Computers help people make decisions by providing correct answers to any question.

   1) true
   2) false
   3) I don't know

8. Computers help people make decisions by telling them if their problem is important.

   1) true
   2) false
   3) I don't know

9. Computers have been used to make more information and products available to the public.

   1) true
   2) false
   3) I don't know

10. Computers are used to commit crimes, especially stealing money and stealing or falsifying information.

    1) true
    2) false
    3) I don't know

11. Identification numbers and passwords are common ways to control the use of computer files.

1) true
2) false
3) I don't know

12. Some computers know just about everything.

1) true
2) false
3) I don't know

13. Use of computers in education always results in less personal treatment of students.

1) true
2) false
3) I don't know

14. Privacy is an issue whenever there are files containing personal information about people.

1) true
2) false
3) I don't know

15. The increased use of computers in our society both eliminates and creates jobs.

1) true
2) false
3) I don't know

16. Almost all people in our society are affected in some way by computers.

1) true
2) false
3) I don't know

17. In order to use a computer, you would have to be in the same building as the computer.

1) true
2) false
3) I don't know

18. Computers are able to think in every way just like people.

1) true
2) false
3) I don't know

PAGE 8

19. Using computers can free one to do more creative tasks, but may also lead to more dependence upon machines.

1) true
2) false
3) I don't know

20. In order to use any computer, you would have to use a telephone.

1) true
2) false
3) I don't know

21. In order to use a computer, a person must know how to program.

1) true
2) false
3) I don't know

22. Some computers have good and bad feelings like people.

1) true
2) false
3) I don't know

23. Computers are <u>not</u> good for tasks that require:

1) speed
2) accuracy
3) intuition
4) something to be done over and over again
5) I don't know

24. If your charge account bill has an error, it was probably caused by:

1) breakdown of the computer
2) mistakes made by people
3) poor design of the computer
4) general weaknesses of machines
5) I don't know

25. The main duty of a computer programmer is to:

1) operate a computer
2) prepare instructions for a computer
3) schedule jobs for a computer
4) design computers
5) I don't know

26. The computer-related job closest to that of a typist is:

1) computer operator
2) keypunch operator
3) systems analyst
4) computer programmer
5) I don't know

27. Which of the following persons is the most likely to help in designing computers?

1) keypunch operator
2) computer operator
3) computer programmer
4) computer scientist
5) I don't know

28. A basic use of computers in libraries involves:

1) information storage and retrieval
2) simulation and modelling
3) process control
4) computation
5) I don't know

29. A basic use for computers in the design of airplanes is:

1) simulation and modelling
2) process control
3) making reservations
4) keeping inventory
5) I don't know

30. Many people disagree about using large computer files in:

1) government planning
2) research
3) checking on people
4) carrying out social programs
5) I don't know

31. Which of the following is a limiting consideration for using computers?

1) cost
2) software availability
3) storage capacity
4) all of the above
5) I don't know

32. In order to program a computer, a person:

1) can use any English language words
2) can use any English or foreign language words
3) must use programming language numbers, not words
4) must use the words from a programming language
5) I don't know

33. A computer program is a:

1) course on computers
2) set of instructions to control the computer
3) show given by the computer
4) piece of computer hardware
5) I don't know

PAGE 10

34. Which is <u>not</u> a characteristic of most information systems?

1) a large amount of data is stored and used
2) the data are organized
3) the basic purpose is to provide reports and summaries of the data
4) letters of the alphabet are used to represent all the data
5) I don't know

35. Choose the correct output for the computer program shown below:

```
10  LET C = 6
20  LET D = 8
30  LET E = C+D+2
40  PRINT E
50  END
```

<u>Output</u>

1) 6
2) 14
3) 8
4) 16
5) I don't know

36. When were computers first manufactured in large numbers?

1) 1860's
2) 1890's
3) 1920's
4) 1950's
5) I don't know

37. Computer software is a term describing:

1) computer programs
2) electronic components covered with soft plastic or rubber
3) people who work with computers
4) mechanical and electronic parts of a computer system
5) I don't know

38. In addition to input and output equipment, computers contain:

1) terminals, paper, transistors
2) memory units, control units, arithmetic units
3) printers and typewriters
4) telephones, keyboards, television screens
5) I don't know

39. A computer <u>system</u> is best described as:

1) processing
2) programming, input, and output
3) input and output
4) input, processing, and output
5) I don't know

40. Choose the correct output for the computer program shown below:

```
10  LET A = 3
20  LET B = 4
30  LET C = A
40  LET B = C
50  LET A = B
60  PRINT A,B
70  END
```

Output

1) 3 4
2) 4 3
3) 3 3
4) 4 4
5) I don't know

41. The physical parts of a computer are referred to as:

1) programs
2) hardware
3) software
4) manuals
5) I don't know

42. When in operation, a computer:

1) follows a set of instructions written by people
2) thinks just like a person
3) decides what to do with the data
4) translates data from digital to analog code
5) I don't know

43. Computers cannot run without:

1) blinking lights
2) keyboards
3) instructions
4) all of the above
5) I don't know

44. What is the main purpose of the following program:

```
10  INPUT A, B, C, D, E
20  LET S = A+B+C+D+E
30  LET M = S/5
40  PRINT S,M
50  END
```

1) store A, B, C, D, and E in the computer
2) print the letters S and M
3) print the sum and average of five numbers
4) calculate large sums
5) I don't know

45. At any given moment, a computer's memory unit can store:

1) programs
2) data
3) answers
4) all of the above
5) I don't know

46. Data processing is best described as:

1) the collection of data
2) producing reports
3) manipulating data according to instructions
4) using punched cards in a keypunch machine
5) I don't know

47. This program instructs the computer to count by two.

```
10  LET M = 0
20  LET M = M+2
30  PRINT M
40  IF M<100 THEN 20
50  END
```

Which change will produce a program which can be used to count by A? (For example, A=3, 5, or 8.)

1)
```
5 READ A
7 DATA 3,5,8
```

2)
```
5 LET M = A
30 PRINT A
```

3)
```
5 INPUT A
20 LET M = M+A
```

4)
```
5 LET X = A
20 LET M = X+A
```

5) I don't know

48. Computer processing of data may involve:

1) searching
2) summarizing
3) deleting
4) all of the above
5) I don't know

49. The computer must have two types of information to solve a problem:

1) the problem and the answer
2) the name of the program and user number
3) the data and the instructions
4) the name of the program and your name
5) I don't know

50. When the following program is run, the user enters numbers for A and B. The computer will:

```
10  INPUT A, B
20  LET A = A+B
30  LET B = A-B
40  LET A = A-B
50  PRINT A,B
60  END
```

1) print the two input numbers, the smallest first
2) print the two input numbers, the largest first
3) print the two input numbers in reverse order from the way they were input
4) print the two input numbers in the same order as they were input
5) I don't know

APPENDIX E

STATE SECTION (STAI)

SELF-EVALUATION QUESTIONNAIRE

Developed by
in collaboration with
, and

STAI Form Y-1

Name _____ Date _____ S ____

Age _____ Sex: M ____ F ____ T ____

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you feel *right* now, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
1. I feel calm	1	2	3	4
2. I feel secure	1	2	3	4
3. I am tense	1	2	3	4
4. I feel strained	1	2	3	4
5. I feel at ease	1	2	3	4
6. I feel upset	1	2	3	4
7. I am presently worrying over possible misfortunes	1	2	3	4
8. I feel satisfied	1	2	3	4
9. I feel frightened	1	2	3	4
10. I feel comfortable	1	2	3	4
11. I feel self-confident	1	2	3	4
12. I feel nervous	1	2	3	4
13. I am jittery	1	2	3	4
14. I feel indecisive	1	2	3	4
15. I am relaxed	1	2	3	4
16. I feel content	1	2	3	4
17. I am worried	1	2	3	4
18. I feel confused	1	2	3	4
19. I feel steady	1	2	3	4
20. I feel pleasant	1	2	3	4

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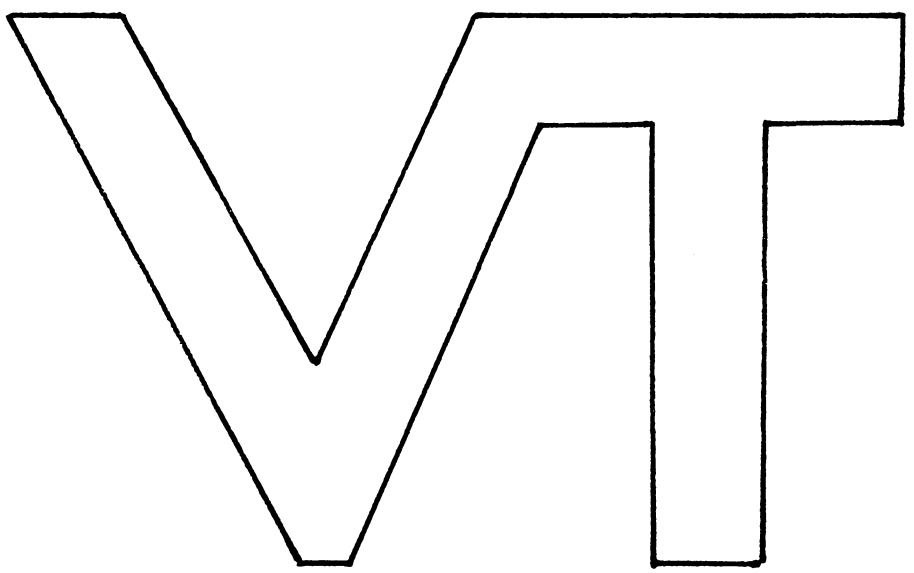
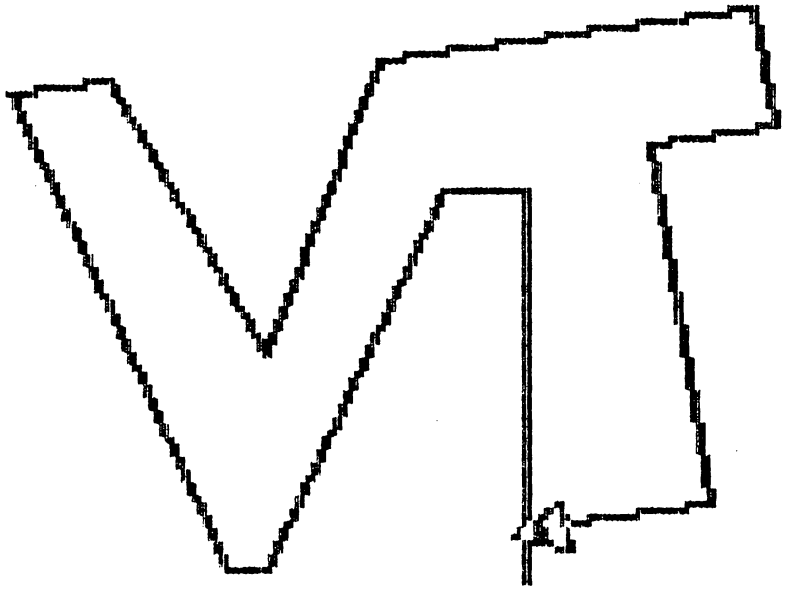
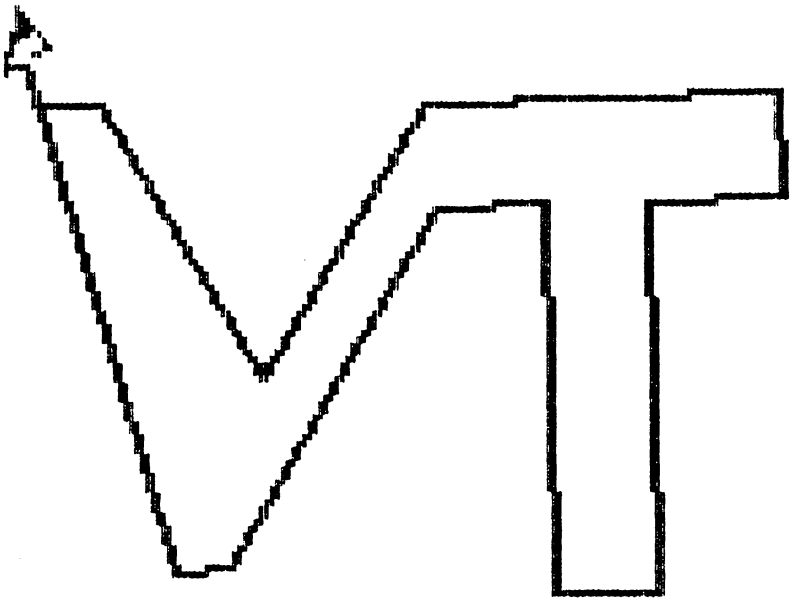
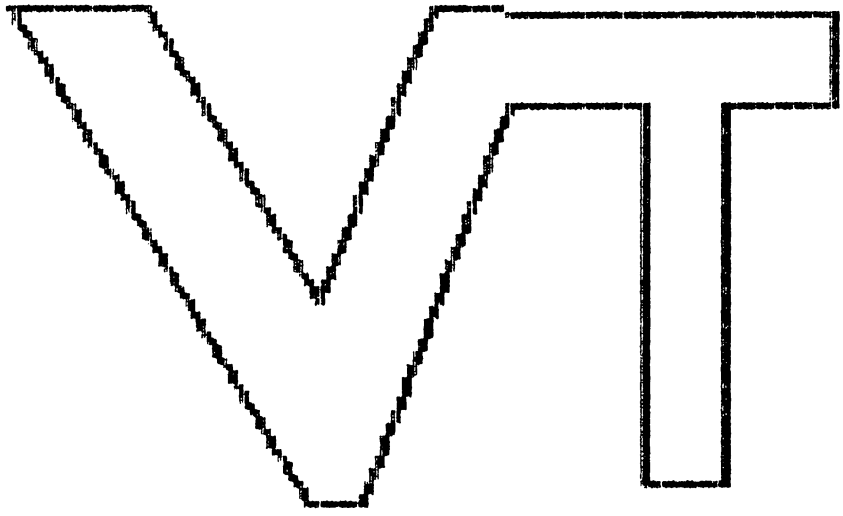
APPENDIX F

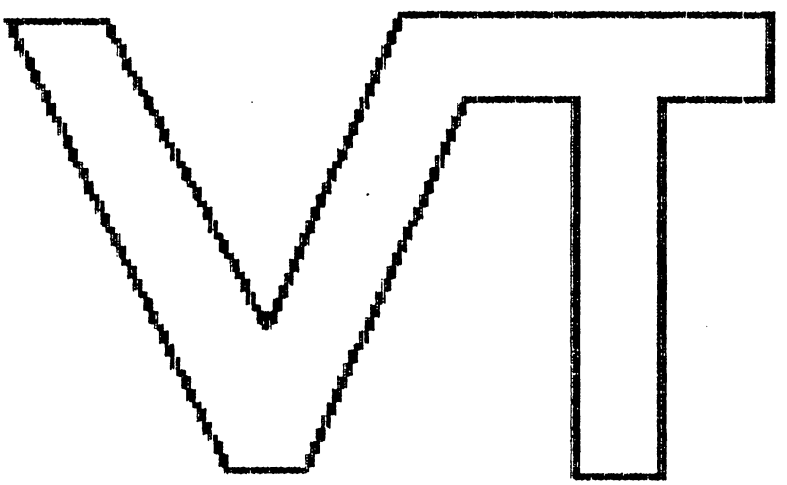
VIRGINIA TECH EMBLEM

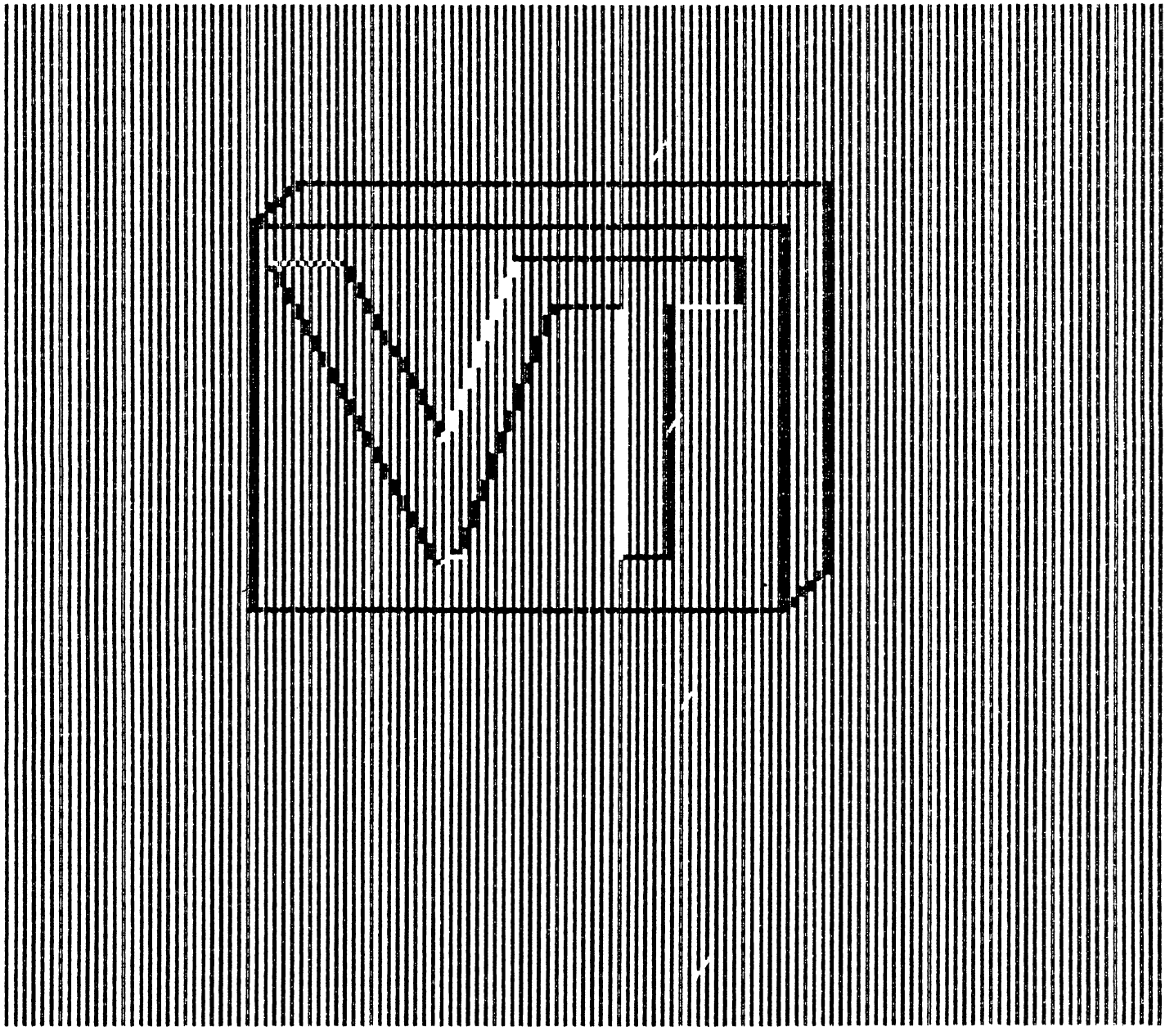












APPENDIX G

COMPUTER USE FORM

COMPUTER USE FORM

I.D. Number	Personal	Classroom	Individual students	Other
123-45-6789	20 min.		2 hours	

APPENDIX H

POST-WORKSHOP MEASUREMENTS

SELF-EVALUATION QUESTIONNAIRE

Developed by
in collaboration with
, , and

STAI Form Y-1

Name _____ Date _____ S ____

Age _____ Sex: M ____ F ____ T ____

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then blacken in the appropriate circle to the right of the statement to indicate how you feel *right* now, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
1. I feel calm	①	②	③	④
2. I feel secure	①	②	③	④
3. I am tense	①	②	③	④
4. I feel strained	①	②	③	④
5. I feel at ease	①	②	③	④
6. I feel upset	①	②	③	④
7. I am presently worrying over possible misfortunes	①	②	③	④
8. I feel satisfied	①	②	③	④
9. I feel frightened	①	②	③	④
10. I feel comfortable	①	②	③	④
11. I feel self-confident	①	②	③	④
12. I feel nervous	①	②	③	④
13. I am jittery	①	②	③	④
14. I feel indecisive	①	②	③	④
15. I am relaxed	①	②	③	④
16. I feel content	①	②	③	④
17. I am worried	①	②	③	④
18. I feel confused	①	②	③	④
19. I feel steady	①	②	③	④
20. I feel pleasant	①	②	③	④

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From the Minnesota Computer Literacy and Awareness Assessment . . .

DIRECTIONS: Indicate how much you AGREE or DISAGREE with each of the following statements by marking the appropriate letter on the answer sheet. Mark "1" if you STRONGLY DISAGREE with the statement. Mark "2" if you DISAGREE with the statement a little. Mark "3" if you are UNDECIDED about whether you agree or disagree with the statement. Mark "4" if you AGREE with the statement a little. Mark "5" if you STRONGLY AGREE with the statement.

As an example, if you AGREE a little that computers are noisy, then mark "4" on the answer sheet as shown below:

Computers are noisy ① ② ③ ● ⑤

Or, if you are UNDECIDED about whether computers are noisy, mark "3" on the answer sheet as shown below:

Computers are noisy ① ② ● ④ ⑤

If you have any questions, ask the test administrator.

Please mark your answers on the answer sheet.

		STRONGLY DISAGREE 1	DISAGREE 2	UNDECIDED 3	AGREE 4	STRONGLY AGREE 5
1.	I would like to learn more about computers . .	1	2	3	4	5
2.	Working with a computer would probably make me feel uneasy or tense	1	2	3	4	5
3.	I feel helpless around a computer	1	2	3	4	5
4.	Computers sometimes scare me	1	2	3	4	5
5.	I would very much like to have my own computer	1	2	3	4	5
6.	I like the idea of taking computer courses	1	2	3	4	5
7.	I enjoy (or think I would enjoy) using computers in my classes	1	2	3	4	5

Please mark your answers on the answer sheet

	STRONGLY DISAGREE 1	DISAGREE 2	UNDECIDED 3	AGREE 4	STRONGLY AGREE 5
8. Walking through a room filled with computers would make me feel uneasy	1	2	3	4	5
9. I feel uneasy when I am with people who are talking about computers	1	2	3	4	5
10. I enjoy (or think I would enjoy) working with computers	1	2	3	4	5
11. I feel confident about my ability to use computers	1	2	3	4	5
12. It is my guess that I am not the kind of person who works well with computers	1	2	3	4	5
13. On the whole, I can cope with computers in my daily living	1	2	3	4	5
14. I am able to work with computers as well as most others my age	1	2	3	4	5
15. Computers are gaining too much control over my life	1	2	3	4	5
16. Every secondary school student should know something about computers	1	2	3	4	5
17. Every secondary school student should be able to write a simple computer program . . .	1	2	3	4	5
18. Every secondary school student should learn about the role that computers play in our society	1	2	3	4	5
19. Computers can be useful in learning many subjects besides mathematics	1	2	3	4	5
20. Computers are of little use in education . .	1	2	3	4	5

DIRECTIONS: Indicate whether you think each of the following values is UNIMPORTANT, IMPORTANT, or EXTREMELY IMPORTANT by marking the appropriate letter on the answer sheet. Mark "1" if you think the value is UNIMPORTANT. Mark "2" if you think the value is IMPORTANT. Mark "3" if you think it is EXTREMELY IMPORTANT.

As an example, if you think saving money is EXTREMELY IMPORTANT, mark "3" on the answer sheet as shown below:

Saving Money ① ② ● ④ ⑤

Please mark your answers on the answer sheet

		UNIMPORTANT 1	IMPORTANT 2	EXTREMELY IMPORTANT 3
1.	Freedom	1	2	3
2.	World Peace	1	2	3
3.	Economic Growth	1	2	3
4.	Science	1	2	3
5.	Privacy	1	2	3
6.	Technology	1	2	3
7.	Love and Friendship	1	2	3
8.	Respecting Yourself	1	2	3
9.	Saving Energy	1	2	3
10.	Protecting the Environment	1	2	3

LOGO QUIZ

Choose the correct meaning of the following LOGO commands:

1. ST

    1. Shoot turtle
    2. Show turtle
    3. Slide turtle

2. FD

    1. Find
    2. Found
    3. Forward

3. RT

    1. Right
    2. Route
    3. Report

4. HT

    1. Hide turtle
    2. Hit turtle
    3. Hold turtle

5. BK

    1. Break
    2. Back
    3. Book

6. LT

    1. Length
    2. Light
    3. Left

Choose the correct meaning of the following EDITING commands:

7. CTRL N

    1. Next line
    2. New line
    3. No line

8. CTRL B

    1. Back
    2. Boot
    3. Bypass

9. CTRL P

    1. Print line
    2. Press line
    3. Previous line

10. CTRL F

    1. Free
    2. Forward
    3. Front

11. CTRL D

    1. Delete
    2. Debug
    3. Down

12. CTRL C

    1. Completed edit
    2. Continue
    3. Cut

Choose the correct command:

13. To get a saved program into computer working memory

    1. LIST
    2. LOAD
    3. KEEP

14. To clear the screen

    1. CS
    2. CN
    3. CL

15. To place the turtle at its starting point

    1. HOME
    2. CLEAR
    3. LOGO

16. To print out all titles

    1. POS
    2. POTS
    3. PRTS

17. To print out all procedures

    1. PTAP
    2. PRPS
    3. POPS

18. To stop the turtle during a procedure

    1. CTRL G
    2. CTRL S
    3. CTRL T

19. To save a procedure on the disk

    1. KEEP
    2. SAVE
    3. RUN

20. To erase all procedures in the computer's memory

    1. ERALL
    2. ENDALL
    3. START

APPENDIX I

COMPUTER BACKGROUND INFORMATION RESULTS

Background Information

The Computer Background Information instrument was used to survey the one hundred thirty-seven teachers who participated in the computer in-service workshops. The following percentages were recorded:

		Treatment	Quasicontrol
1.	Level of education:		
	1) Bachelors	57.5%	50.0%
	2) Masters	40.0%	44.6%
	3) PostMasters	2.5%	5.4%
2.	Grade you are teaching this year:		
	1) Kindergarten	15.0%	8.9%
	2) First	15.0%	14.3%
	3) Second	11.2%	12.5%
	4) Third	10.0%	8.9%
	5) Fourth	13.7%	12.5%
	6) Fifth	13.7%	17.9%
	7) Other	21.2%	25.0%
3.	Years of teaching:		
	1) 1-5	18.8%	12.5%
	2) 6-10	28.7%	32.1%
	3) 11-15	31.3%	25.0%
	4) 16-20	10.0%	17.9%
	5) 21 plus	11.2%	12.5%
4.	Age:		
	1) 20-30	25.0%	19.6%
	2) 31-40	40.0%	33.9%
	3) 41-50	25.0%	32.1%
	4) 51 plus	10.0%	14.3%

5. Number of computer courses:

1)	0	77.5%	48.2%
2)	1	13.7%	42.9%
3)	2	6.3%	3.6%
4)	3	1.2%	5.4%
5)	4 plus	1.2%	0%

6. Course location:

1)	None	67.5%	41.1%
2)	Tech	7.5%	26.8%
3)	Radford	1.2%	12.5%
4)	NRCC	1.2%	0%
5)	Dealership	7.5%	0%
6)	Other	15.0%	19.6%

7. Do you have a home computer?

1)	Yes	17.5%	26.8%
2)	No	81.3%	73.2%
	No response	1.2%	

8. How many hours per week do you use a computer?

1)	0	80.0%	73.2%
2)	1-5	17.5%	25.0%
3)	6-10	1.2%	1.8%
4)	11 plus	1.2%	0%

9. Have you used the school computer in your classroom?

1)	Yes	50.0%	64.3%
2)	No	48.7%	35.7%
	No response	1.2%	

10. Have your students used the computer in a location other than your classroom?

1)	Yes	41.2%	76.8%
2)	No	57.5%	23.2%
	No response	1.2%	

11. Who supervises your students' computer work?

1)	You	31.3%	53.6%
2)	Parent volunteer	7.5%	19.6%
3)	Another teacher	12.5%	16.1%
4)	No one	31.3%	1.8%
5)	Other	17.5%	8.9%

12. Evaluate your typing skill:

1)	Excellent	5.0%	3.6%
2)	Good	22.5%	23.2%
3)	Average	47.5%	42.9%
4)	Poor	25.0%	28.6%
	No response		1.8%

APPENDIX J

COMPUTER LITERACY RESULTS

Computer Literacy and Awareness Assessment (Part I)

Percentages of response given by the

Treatment and Quasicontrol groups

		Treatment	Quasicontrol
1.	Police sometimes use computers to help identify stolen cars.		
* 1)	true	93.8%	91.1%
2)	false	1.2%	0%
3)	I don't know	5.0%	8.9%
2.	Most nurses give injections by computer.		
1)	true	2.5%	5.4%
* 2)	false	78.7%	82.1%
3)	I don't know	18.8%	12.5%
3.	Computers cannot be used to assist in teaching English grammar.		
1)	true	1.2%	0%
* 2)	false	93.8%	100.0%
3)	I don't know	5.0%	0%
4.	Computers are not really used very much yet except by scientists.		
1)	true	1.2%	1.8%
* 2)	false	98.7%	98.2%
3)	I don't know	0%	0%
5.	Government officials use computers to store and retrieve large amounts of information about citizens.		
* 1)	true	88.7%	83.9%
2)	false	6.3%	3.6%
3)	I don't know	5.0%	12.5%

6.	People often use computers to store large amounts of information they wish to use over and over again.			
*	1)	true	93.8%	100.0%
	2)	false	3.7%	0%
	3)	I don't know	2.5%	0%
7.	Computers help people make decisions by providing correct answers to any question.			
	1)	true	20.0%	16.1%
*	2)	false	67.5%	82.1%
	3)	I don't know	12.5%	1.8%
8.	Computers help people make decisions by telling them if their problem is important.			
	1)	true	8.7%	0%
*	2)	false	70.0%	91.1%
	3)	I don't know	21.2%	8.9%
9.	Computers have been used to make more information and products available to the public.			
*	1)	true	91.2%	94.6%
	2)	false	2.5%	0%
	3)	I don't know	6.3%	5.4%
10.	Computers are used to commit crimes, especially stealing money and stealing or falsifying information.			
*	1)	true	80.0%	71.4%
	2)	false	5.0%	14.3%
	3)	I don't know	15.0%	14.3%
11.	Identification numbers and passwords are common ways to control the use of computer files.			
*	1)	true	87.5%	87.5%
	2)	false	1.2%	1.8%
	3)	I don't know	11.2%	10.7%

12.	Some computers know just about everything.			
	1)	true	17.5%	21.4%
*	2)	false	73.7%	71.4%
	3)	I don't know	8.7%	7.1%
13.	Use of computers in education always results in less personal treatment of students.			
	1)	true	8.7%	1.8%
*	2)	false	81.3%	89.3%
	3)	I don't know	10.0%	8.9%
14.	Privacy is an issue whenever there are files containing personal information about people.			
*	1)	true	97.5%	89.3%
	2)	false	1.2%	3.6%
	3)	I don't know	1.2%	7.1%
15.	The increased use of computers in our society both eliminiates and creates jobs.			
*	1)	true	97.5%	100.0%
	2)	false	1.2%	0%
	3)	I don't know	1.2%	0%
16.	Almost all people in our society are affected in some ways by computers.			
*	1)	true	98.7%	100.0%
	2)	false	1.2%	0%
	3)	I don't know	0%	0%
17.	In order to use a computer, you would have to be in the same building as the computer.			
	1)	true	2.5%	5.4%
*	2)	false	88.7%	92.9%
	3)	I don't know	8.7%	1.8%

18. Computers are able to think in every way just like people.

	1)	true	6.3%	12.5%
*	2)	false	87.5%	87.5%
	3)	I don't know	6.3%	0%

19. Using computers can free one to do more creative tasks, but may also lead to more dependence upon machines.

*	1)	true	77.5%	82.1%
	2)	false	11.2%	7.1%
	3)	I don't know	11.2%	10.7%

20. In order to use any computer, you would have to use a telephone.

	1)	true	0%	0%
*	2)	false	96.2%	100.0%
	3)	I don't know	3.7%	0%

21. In order to use a computer, a person must know how to program.

	1)	true	6.3%	8.9%
*	2)	false	82.5%	83.9%
	3)	I don't know	11.2%	7.1%

22. Some computers have good and bad feelings like people.

	1)	true	6.3%	1.8%
*	2)	false	73.7%	83.9%
	3)	I don't know	20.0%	14.3%

23.	Computers are not good for tasks that require:			
	1)	speed	1.2%	1.8%
	2)	accuracy	1.2%	0%
*	3)	intuition	81.3%	91.1%
	4)	something to be done over and over	2.5%	0%
	5)	I don't know	13.7%	7.1%
24.	If your charge account bill has an error, it was probably caused by:			
	1)	breakdown of the computer	3.7%	7.1%
*	2)	mistakes made by people	83.7%	83.9%
	3)	poor design of the computer	0%	0%
	4)	general weaknesses of machines	2.5%	1.8%
	5)	I don't know	10.0%	7.1%
25.	The main duty of a computer programmer is to:			
	1)	operate a computer	10.0%	8.9%
*	2)	prepare instructions for a computer	72.5%	89.3%
	3)	schedule jobs for a computer	3.7%	0%
	4)	design computers	2.5%	0%
	5)	I don't know	11.2%	1.8%
26.	The computer-related job closest to that of a typist is:			
	1)	computer operator	6.3%	7.1%
*	2)	keypunch operator	60.0%	73.2%
	3)	systems analyst	1.2%	0%
	4)	computer programmer	10.0%	7.1%
	5)	I don't know	22.5%	12.5%

27. Which of the following persons is the most likely to help in designing computers?

	1)	keypunch operator	1.2%	0%
	2)	computer operator	0%	0%
	3)	computer programmer	3.7%	3.6%
*	4)	computer scientist	72.5%	82.1%
	5)	I don't know	22.5%	14.3%

28. A basic use of computers in libraries involves:

*	1)	information storage and retrieval	76.2%	89.3%
	2)	simulation and modelling	0%	1.8%
	3)	process control	5.0%	1.8%
	4)	computation	1.2%	0%
	5)	I don't know	17.5%	7.1%

29. A basic use for computers in the design of airplanes is:

*	1)	simulation and modelling	51.2%	62.5%
	2)	process control	3.7%	7.1%
	3)	making reservations	3.7%	5.4%
	4)	keeping inventory	2.5%	1.8%
	5)	I don't know	38.7%	23.2%

30. Many people disagree about using large computer files in:

	1)	government planning	3.7%	5.4%
	2)	research	0%	1.8%
*	3)	checking on people	45.0%	53.6%
	4)	carrying out social programs	10.0%	10.7%
	5)	I don't know	41.2%	28.6%

31. Which of the following is a limiting consideration for using computers?

	1)	cost	17.5%	14.3%
	2)	software availability	1.2%	1.8%
	3)	storage capacity	1.2%	1.8%
*	4)	all of the above	67.5%	71.4%
	5)	I don't know	12.5%	10.7%

32. In order to program a computer, a person:

	1)	can use any English language words	1.2%	0%
	2)	can use any English or foreign language	3.7%	3.6%
	3)	must use programming language numbers, not words	0%	0%
*	4)	must use the words from a programming language	72.5%	73.2%
	5)	I don't know	22.5%	23.2%

33. A computer program is a:

	1)	course on computers	2.5%	1.8%
*	2)	set of instructions to control a computer	75.0%	89.3%
	3)	show given by the computer	2.5%	3.6%
	4)	piece of computer hardware	6.3%	5.4%
	5)	I don't know	13.7%	0%

34. Which is not a characteristic of most information systems?

	1)	a large amount of data is stored and used	0%	0%
	2)	the data are organized	0%	0%
	3)	the basic purpose is to provide reports and summaries of the data	10.0%	5.4%
*	4)	letters of the alphabet are used to represent all the data	43.8%	58.9%
	5)	I don't know	46.2%	35.7%

35. Choose the correct output for the computer program shown below:

```
10  LET C = 6
20  LET D = 8
30  LET E = C + D + 2
40  PRINT E
50  END
```

Output

1)	6	0%	0%
2)	14	1.2%	1.8%
3)	8	0%	0%
* 4)	16	58.7%	62.5%
5)	I don't know	40.0%	35.7%

36. When were computers first manufactured in large numbers?

1)	1860's	2.5%	0%
2)	1890's	1.2%	1.8%
3)	1920's	2.5%	0%
* 4)	1950's	58.7%	82.1%
5)	I don't know	35.0%	16.1%

37. Computer software is a term describing:

* 1)	computer programs	75.0%	87.5%
2)	electronic components covered with soft plastic or rubber	8.7%	10.7%
3)	people who work with computers	0%	0%
4)	mechanical and electronic parts of a computer system	3.7%	0%
5)	I don't know	12.5%	1.8%

38. In addition to input and output equipment, computers contain:

1)	terminals, paper, transistors	0%	7.1%
* 2)	memory units, control units, arithmetic units	37.5%	39.3%
3)	printers and typewriters	6.3%	19.6%
4)	telephones, keyboards, television screens	11.2%	8.9%
5)	I don't know	45.0%	25.0%

39. A computer system is best described as:

1)	processing	0%	0%
2)	programming, input, and output	11.2%	32.1%
3)	input and output	1.2%	0%
* 4)	input, processing, and output	56.3%	46.4%
5)	I don't know	31.3%	21.4%

40. Choose the correct output for the computer program shown below:

```
10  LET A = 3
20  LET B = 4
30  LET C = A
40  LET B = C
50  LET A = B
60  PRINT A,B
70  END
```

Output

1)	3 4	17.5%	30.4%
2)	4 3	6.3%	1.8%
* 3)	3 3	15.0%	21.4%
4)	4 4	1.2%	1.8%
5)	I don't know	60.0%	42.9%
6)	No response		1.8%

41. The physical parts of a computer are referred to as:

1)	programs	2.5%	0%
* 2)	hardware	80.0%	92.9%
3)	software	2.5%	0%
4)	manuals	2.5%	1.8%
5)	I don't know	12.5%	5.4%

42. When in operation, a computer:

* 1)	follows a set of instructions written by people	72.5%	73.2%
2)	thinks just like a person	0%	0%
3)	decides what to do with the data	1.2%	5.4%
4)	translates data from digital to analog code	11.2%	7.1%
5)	I don't know	15.0%	14.3%

43. Computers cannot run without:

1)	blinking lights	0%	0%
2)	keyboards	0%	5.4%
* 3)	instructions	56.3%	69.6%
4)	all of the above	31.3%	19.6%
5)	I don't know	12.5%	5.4%

44. What is the main purpose of the following program?

```
10  INPUT A, B, C, D, E
20  LET S = A+B+C+D+E
30  LET M = S/5
40  PRINT S,M
50 END
```

1)	store A, B, C, D, and E in the computer	0%	1.8%
2)	print the letters S and M	2.5%	1.8%
* 3)	print the sum and average of five numbers	42.5%	50.0%
4)	calculate large sums	2.5%	1.8%
5)	I don't know	52.5%	44.6%

45. At any given moment, a computer's memory unit can store:

1)	programs	0%	1.8%
2)	data	16.2%	8.9%
3)	answers	2.5%	0%
* 4)	all of the above	68.8%	78.6%
5)	I don't know	12.5%	10.7%

46. Data processing is best described as:

1)	the collection of data	3.7%	8.9%
2)	producing reports	0%	0%
* 3)	manipulating data according to instructions	60.0%	66.1%
4)	using punched cards in a keypunch machine	2.5%	1.8%
5)	I don't know	33.7%	23.2%

47. This program instructs the computer to count by two.

```
10  LET M = 0
20  LET M = M + 2
30  PRINT M
40  IF M < 100 THEN 20
50 END
```

Which change will produce a program which can be used to count by A? (For example, A=3, 5 or 8.)

1)	5 READ A 7 DATA 3,5,8	1.2%	3.6%
2)	5 LET M = A 30 PRINT A	1.2%	8.9%
* 3)	5 INPUT A 20 LET M = M + A	10.0%	12.5%
4)	5 LET X = A 20 LET M = X + A	7.5%	10.7%
5)	I don't know	80.0%	64.3%

48. Computer processing of data may involve:

1)	searching	0%	10.7%
2)	summarizing	0%	1.8%
3)	deleting	2.5%	0%
* 4)	all of the above	75.0%	71.4%
5)	I don't know	22.5%	16.1%

49. The computer must have two types of information to solve a problem:

1)	the problem and the answer	5.0%	5.4%
2)	the name of the program and user number	1.2%	3.6%
* 3)	the data and the instructions	63.7%	82.1%
4)	the name of the program and your name	1.2%	0%
5)	I don't know	28.7%	8.9%

50. When the following program is run, the user enters numbers for A and B. The computer will:

```
10  INPUT A,B
20  LET A = A+B
30  LET B = A-B
40  LET A = A-B
50  PRINT A,B
60  END
```

1)	print the two input numbers, the smallest first	0%	1.8%
2)	print the two input numbers, the largest first	5.0%	7.1%
* 3)	print the two input numbers in reverse order from the way they were input	6.3%	5.4%
4)	print the two input numbers in the same order as they were input	7.5%	21.4%
5)	I don't know	80.0%	64.3%
6)	No response		1.2%

APPENDIX K

LOGO QUIZ RESULTS

LOGO QUIZ

Results

Choose the correct meaning of the following LOGO commands:

			Treatment	Quasicontrol
1.	ST			
	1)	Shoot turtle	6.3%	15.8%
*	2)	Show turtle	92.5%	63.2%
	3)	Slide turtle	1.2%	21.1%
2.	FD			
	1)	Find	0%	26.3%
	2)	Found	1.2%	7.0%
*	3)	Forward	98.7%	66.7%
3.	RT			
*	1)	Right	98.7%	89.5%
	2)	Route	1.2%	3.5%
	3)	Report	0%	7.0%
4.	HT			
*	1)	Hide turtle	98.7%	35.1%
	2)	Hit turtle	0%	10.5%
	3)	Hold turtle	1.2%	54.4%
5.	BK			
	1)	Break	0%	24.6%
*	2)	Back	100.0%	73.7%
	3)	Book	0%	1.8%
6.	LT			
	1)	Length	0%	10.5%
	2)	Light	1.2%	5.3%
*	3)	Left	98.7%	84.2%

*Indicates correct answer

Choose the correct meaning of the following EDITING commands:

7.	CTRL N			
	* 1)	Next line	96.2%	43.9%
	2)	New line	2.5%	47.4%
	3)	No line	1.2%	8.8%
8.	CTRL B			
	* 1)	Back	93.8%	59.6%
	2)	Boot	3.7%	10.5%
	3)	Bypass	2.5%	29.8%
9.	CTRL P			
	1)	Print line	5.0%	63.2%
	2)	Press line	1.2%	8.8%
	* 3)	Previous line	93.8%	28.1%
10.	CTRL F			
	1)	Free	3.7%	21.1%
	* 2)	Forward	91.2%	73.7%
	3)	Front	5.0%	5.3%
11.	CTRL D			
	* 1)	Delete	93.8%	78.9%
	2)	Debug	0%	1.8%
	3)	Down	6.3%	19.3%
12.	CTRL C			
	* 1)	Completed edit	87.5%	28.1%
	2)	Continue	10.0%	64.9%
	3)	Cut	2.5%	7.0%

Choose the correct command:

13.	To get a saved program into computer working memory			
	1)	LIST	3.7%	17.5%
	* 2)	LOAD	85.0%	47.4%
	3)	KEEP	11.2%	35.1%

14. To clear the screen

*	1)	CS	95.0%	31.6%
	2)	CN	1.2%	7.0%
	3)	CL	3.7%	61.4%

15. To place the turtle at its starting point

*	1)	HOME	88.7%	78.9%
	2)	CLEAR	6.3%	8.8%
	3)	LOGO	5.0%	12.3%

16. To print out all titles

	1)	POS	0%	1.8%
*	2)	POTS	96.2%	21.1%
	3)	PRTS	3.7%	77.2%

17. To print out all procedures

	1)	PTAP	1.2%	15.8%
	2)	PRPS	3.7%	61.4%
*	3)	POPS	95.0%	22.8%

18. To stop the turtle during a procedure

*	1)	CTRL G	76.2%	7.0%
	2)	CTRL S	16.2%	70.2%
	3)	CTRL T	7.5%	22.8%

19. To save a procedure on the disk

	1)	KEEP	1.2%	17.5%
*	2)	SAVE	95.0%	82.5%
	3)	RUN	3.7%	0%

20. To erase all procedures in the computer's memory

*	1)	ERALL	100.0%	57.9%
	2)	ENDALL	0%	35.1%
	3)	START	0%	7.0%

APPENDIX L

ANOVA SUMMARY TABLES

Anova Summary Tables

ANOVA: Trait Anxiety with Pre/Post State Anxiety (difference scores)

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
Between	47.62	2	47.62
Within	13324.35	76	6662.18
Total	13371.97		

$F = 7.1482$

ANOVA: Trait Anxiety with Computer Literacy

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
Between	82.20	2	82.20
Within	5240.99	77	2620.49
Total	5323.19		

$F = .0314$

ANOVA: Trait Anxiety with Affective Score

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
Between	1022.69	2	1022.69
Within	7781.11	77	3890.55
Total	8803.80		

$F = .2628$

ANOVA: Trait Anxiety with LOGO Score

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
Between	16.56	2	16.56
Within	405.39	77	202.70
Total	421.95		

$F = .0817$

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THE EFFECTS OF IN-SERVICE WORKSHOPS ON COMPUTER ANXIETY IN ELEMENTARY TEACHERS

by

Wanda Leigh Price

(ABSTRACT)

The computer education literature documents computer anxiety as a problem common to classroom teachers without prior computer training. This study was an investigation of the effectiveness of workshops designed to reduce such anxiety.

The treatment comprised of instruction based upon principles derived from the literature was administered to 80 teachers in a Treatment group and 57 teachers in a Quasi-control group. Pre-test measurements included a Computer Background Information survey, Part II of the Minnesota Computer Literacy and Awareness Assessment and the Trait section of the Spielberger State Trait Anxiety Inventory (STAI). Post-test measures were the State section of the State Trait Anxiety Inventory, Part I of the Minnesota Computer Literacy and Awareness Assessment and a LOGO quiz.

Statistical treatment of the data included T-test comparisons between Treatment and Quasi-control groups on tests of computer knowledge; Chi-square test of independence between groups on descriptive characteristics and a one-way analysis of variance testing the relationship between test anxiety and achievement.

Findings confirm an inverse relationship between computer knowledge and computer anxiety. The workshop treatment derived from the literature on in-service training and computer anxiety was an effective vehicle for increasing teacher knowledge and reducing computer anxiety. Study results show that teachers exposed to the treatment workshops reported an increase in positive attitudes toward computer use. Comparisons of pre- and post-workshop State anxiety measurements yielded evidence of significant computer anxiety reduction.