TEACHER USE OF MICROCOMPUTERS IN THE SCHOOLS

by

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(Abstract)

Currently school districts, using a variety of approaches, are in various stages of implementing the microcomputer for classroom task use. While research exists about change (Goodlad, 1992), implementation (Bond, 1988), inservice training (Ellis & Kuerbis, 1992), and student classroom accomplishment using the microcomputer (Bailey, 1990), studies have not examined teacher expectations and implementations while using microcomputers, following an inservice course, and the accompanying obstacles and resulting problem solving strategies.

This study explored the expectations teachers have for using the microcomputer, the tasks for which they implement use, the obstacles encountered, and the strategies created to overcome those obstacles. Further, the study showed how implementation was effected by the school system as a whole and by the teachers who had taken a microcomputer inservice course. Two hundred and ninety-four teachers and seventeen administrators were surveyed in 1985 and sixty-seven teachers and nine administrators were surveyed in 1992.

This study found that administrators changed inservice programs and purchased additional hardware and software between the two survey years. Teacher

expectations were high in both years, with the 1985 sample implementing fewer tasks than the 1992 sample. In 1992, the difference between expectation and implementation was smaller than in 1985. Other findings include information about demographic characteristics, obstacles and strategies. Some demographic characteristics of the teachers studied differed over time. For example, teachers in the 1985 sample were less experienced in microcomputer use than teachers in the 1992 sample, but in both years math teachers composed the largest inservice group. Obstacles existed in both years with physical obstacles ranking highest in 1985 and support obstacles ranking highest in 1992. Teachers studied employed strategies in both years. While the 1985 sample used home strategies about as often as school strategies, school strategies predominated among those sampled in 1992.

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TABLE OF CONTENTS

Page

Abstract ii

Acknowledgements iv

Table of Contents vi

List of Tables x

List of Illustrations xii

CHAPTER I. INTRODUCTION 1

Statement of the Problem 7

Rationale 10

Significance of this Study 13

Assumptions, Delimitations and Limitations of the Study 14

Definition of Terms 15

CHAPTER II. REVIEW OF LITERATURE 19

Change and Innovation 19

Technology Change 24

Expectations 26

Implementation 28

Inservice Training 32

Microcomputers 34
Inservice Training and Technology 37
CHAPTER III. METHODOLOGY 41
Description of Population 41
Setting of Study 43
Procedures 43
Sample 44
The Pilot Study 46
Data Analysis 47
CHAPTER IV. RESULTS 52
The Survey 52
Demographics 53
Characteristic Tables 54
Expectations 60
Classroom Management 61
Instruction About Microcomputer 63
Instruction About Subject 66
Evaluation Activities 68
Summary of Teachers' Expectations 70
Implementation 71
Classroom Management 72

Instruction About Microcomputer 74
Instruction About Subject 74
Evaluation Activities 76
Summary of Teachers' Expectations 78
Expectations in Relation to Implementation 80
Obstacles 83
Strategies 87
Obstacles and Implementation 91
Strategies and Implementation 92
Summary 92
CHAPTER V. OVERVIEW, CONCLUSIONS, AND RECOMMENDATIONS . . 94
Overview of Results 94
Changes Over Time 95
Findings 98
Difference of Teacher Demographic Characteristics and Prior Microcomputer Experience 98
Expectations Over Time 99
Implementations Over Time 100
Expectations and Implementations 103
Obstacles 105
Strategies 106

Obstacles and Implementation 107

Strategies and Implementation 108

Conclusions 109

Recommendations 109

Implications for Current Practice 109

Implications for Further Research 111

APPENDICES 113

Appendix A - Context of Study 113

Appendix B - Questionnaire 128

Appendix C - Questionnaire Correspondence 134

Appendix D - Demographic of Implementation 140

Appendix E - Expectation and Implementations by Number of Tasks . . . 152

Appendix F - Obstacles and Strategies by Number of Tasks 165

Appendix G - Obstacles and Strategies Implementation by Number of Tasks 177

REFERENCES 190

VITA 195

LIST OF TABLES

TABLE		PAGE
1	A Comparison of Characteristics of Teachers in FCPS Inservice Training By Years Studied	55
2	A Comparison of Participating Teachers' Previous Experience With Microcomputers By Years Studied	56
3	A Comparison of Participating Teachers' Reasons for Taking Inservice Microcomputer Courses	58
4	A Comparison of Teachers Expecting to Use Microcomputers in Classroom Management Across Time	62
5	A Comparison of Teachers Expecting to Use Microcomputers in Instruction About Subject Across Time	64
6	A Comparison of Teachers Expecting to Use Microcomputers in Instruction About Subject Matter Across Time	67
7	A Comparison of Teachers Expecting to use Microcomputers in Evaluation Activities Across Time	69
8	A Comparison of Teachers Implementing Classroom Management Tasks Using Microcomputers Across Time	73

9 A Comparison of Teachers Implementing Instruction About Microcomputer Tasks Using Microcomputers Across Time 75

10 A Comparison of Teachers Implementing Instruction About Subject Using Microcomputers Across Time 75

11 A Comparison of Teachers Implementing Tasks in Evaluation Activities Using Microcomputers Across Time 77

12 A Comparison of Expectations Related to Implementations For Microcomputer use in Individual Tasks Across Time 81

13 A Comparison of Obstacles Reported By Area By Year 85

14 A Comparison of Strategies Reported By Area By Year 89

LIST OF FIGURES

FIGURE		PAGE
1	Expected Relationship of Expectations to Implement to Actual Implementation	11
2	Months Lapse Between Inservice Course and First Implementation	59
3	Number of Obstacles Reported By Teachers By Type By Year	86
4	Number of Strategies Reported By Teachers By Type By Year	90

CHAPTER I

Introduction

The institution of education, which is constantly being called upon to change, has recently been bombarded by yet another innovation, that of the microcomputer. Since education often mirrors changes in society, which continues to be in the midst of the application of the microcomputer in every phase of life, pressure from inside and outside the educational community for innovation using the microcomputer in classroom tasks came as no surprise to educators. Because the microcomputer revolution, which many have skillfully turned into a positive, permanent evolution, has impacted upon the educational system, school systems have developed and continue to improve upon plans for systematic implementation. What are the issues involved in this microcomputer evolution? Some areas of exploration in this evolution of microcomputer implementation include ways to accomplish such an evolution in a school system, such as problem solving approaches and inservice training, the expectations the school system and the teacher bring to the implementation process, possible hindrances to implementation, strategies that facilitate implementation, and ultimately how best to support teacher use of the microcomputer.

On the practical level, for many years prior to the introduction of the personal microcomputer, some schools offered microcomputer courses in business subject areas. Some administrative offices also used microcomputers to process records and

correspondence. However, use of the microcomputer by teachers in general, and more specifically the use of the microcomputer in the classroom is a much more recent phenomenon. With this innovation came a whole new view of application of the microcomputers to the instructional program. Pressures from communities for microcomputer use in classrooms intensified until school systems across the United States began to respond by quickly allocating funds for the establishment of instructional technology programs. Today some communities have very sophisticated programs for teacher training, equipment allocation, and classroom use, while others have made only a token response to community pressure concerning curriculum innovation, using microcomputers to accomplish tasks in the classroom (Isherwood, 1990).

Change can be perceived as an adventure, a challenge, or a source of fear. Change can be welcomed or resisted. If change is to be accomplished, systems and teachers must be well prepared. As Mahmood and Hirt (1992) state, technology integration is a complex matter and must include needs assessments, long-range goals, upper management encouragement, teacher inservice training, and a teacher integration plan or implementation model. In 1985, Fairfax County consonant with this advice began solving the problem by listing and analyzing their expectations of what would be possible (initially thinking about inservice programming and later, in 1992, software) and then by enlisting participation on a voluntary basis with schools and also individual teachers. In both 1985 and 1992, expectations may have

influenced what the county thought was possible and what direction and form problem solving took. In 1992, the use of problem solving to make expectations become a reality required a regrouping and rethinking, as the results of the start in 1985 and the ensuing years were analyzed in light of continuing equipment and software advances. Thus, through familiarity with the change process, the county implemented, first on a small basis and eventually by 1992 on a county-wide basis, the use of microcomputers by every administrator, teacher and student, either through a school based lab or in individual classrooms.

These issues fell into three general areas: the demographics of teachers who took the microcomputer course and attempted implementation, system and teacher expectations and implementation, and obstacles found and strategies used to achieve implementation. These areas led to the following questions: (1) What were the differences in experience during the early and later stage of implementation?; (2) What did we as educators both on the system and teacher levels expect to do with this innovation related to both time periods, 1985 and 1992?; (3) What did we as educators both on the system and teacher levels implement in 1985 and 1992?; (4) How closely did expectations match implementation in 1985 and 1992?; (5) What were the obstacles to usage encountered in both time periods?; (6) What strategies were employed to facilitate use in both 1985 and 1992?; (7) What was the relationship between the number of obstacles and the actual implementation in both time periods?; and (8) What was the relationship between the strategies used and the

actual implementation in 1985 and 1992?

Most research concerning microcomputers has only addressed the state of the art (Hall, 1992; Reinhold, 1985). This research tends to investigate the general diffusion of microcomputers and their use in the school systems. Several studies are based on student achievement with the use of Microcomputer Assisted Instruction on the microcomputer as compared to nonuse in the same instructional area (Parker, 1985). Some studies have begun to probe attitudes of teachers and administrators toward the implementation of microcomputers in the classroom, with either the math subject area or the elementary classroom being the primary focus (Bond, 1988; Hancock, 1991; Wedman, 1988). Studies have also investigated resistance to technology (Khamis, 1992). Some research has begun to link inservice training with educational technology (Bailey, 1990). Lastly, Trembley (1992) explored ways to make the microcomputer more user friendly. Few studies, however, have taken the investigation into the exploration of teacher action as opposed to teacher attitudes. There is little information about expectations and actual implementation following inservice training about microcomputers.

Even fewer studies in the field of education, let alone the specific field of microcomputer usage, have investigated action over an extended period of time. This is an important next step as it builds on the foundation of research which has already been laid. With the huge investment of money, time, talent, and effort this innovation of the microcomputer demands that school systems know what is actually

happening in the classroom as a result of this interest and effort. Thus, research has taken us step-by-step from the basic introduction of the microcomputer through the diffusion and attitudes of initial use. The time has now come to catalog and evaluate some of this use.

In exploring the development of an innovation and its impact on classroom use, the natural process, then, begins with its introduction, proceeding to interest, evaluation, training, trial adoption, and finally ending with integration of the innovation into the curriculum. Studies of innovation and adoption of innovations begin with research on the willingness to innovate and change; diffusion; attitudes of users; and effects on recipients. This leads ultimately to creative hopes and actions of users on two levels. First the school system and secondly the teacher. The microcomputer itself and research concerning it has followed some of the above stages. However, to date no studies have explored this innovation during two separate survey years. Such an exploration makes it possible to study change.

This study will investigate expectations in two separate time periods to implement the innovation of the microcomputer by teachers who have taken an introductory microcomputer inservice course through a public school system. It will also address the degree to which they actually implemented the usage of the microcomputer in their classroom despite obstacles, (such as lack of support or shortage of materials), and also the strategies teachers used to overcome these obstacles in two separate survey years, 1985 and 1992.

The context of this study is Fairfax County Public Schools (FCPS) located in Fairfax County, Virginia, a relatively affluent, but diverse suburb of Washington, D.C. The teachers concerned in this study were surveyed for the first time in 1985 and again in 1992. The Fairfax County Public School system first embraced microcomputer use in the administrative/business departments in 1967, and then between 1967 and 1980 began to address the possibility of microcomputer instructional applications. Between 1980 and 1984, Atari was initially chosen as the hardware to be used in the pyramid pilot program due to the closed unit design and the creation of some instructional software. Later, Apple microcomputers were used extensively in the system as a result of hardware improvements and a vast array of available instructional software. During this period a few model microcomputer labs were created at selected schools in the system. In 1984, the system received a federal grant through Project LITT, Learning Improvement Through Technology, which enabled the establishment of exploratory activities in using the microcomputer as a tool to support instructional objectives beyond microcomputer literacy.

By 1986, teacher training included microcomputer applications across all disciplines. Equipment and software purchase evaluation and selection guidelines were in place, and microcomputer classroom instruction was countrywide. Between 1986 and 1992, curriculum was fundamentally changed to reflect microcomputer emphasis in several subject areas for enrichment as well as remediation. During 1991 and 1992, budget cutbacks impacted on the program in some areas, such as school

based microcomputer staff layoffs and the need to replace old microcomputers with current models to insure equity across the system.

Thus, during this period, 1967 to 1992, the system and teachers experienced the innovation of the microcomputer from initial embracement to actual implementation. During two separate survey years, 1985 and 1992, teachers were involved in two very different time periods of microcomputer implementation. What did these teachers expect to do in their classrooms after taking the microcomputer course? What was their reaction to change and technology? What obstacles did they encounter? What strategies did they use to overcome any problems of implementation? What was actually implemented? What differed across time? These and other questions were explored in this study to gain further depth of understanding of the most effective use of this newest innovation in education.

Statement of the Problem

Why isn't expected implementation of the microcomputer taking place in the school system? Why aren't the hopes of teachers who have taken a county microcomputer course being realized? What is preventing the use of the microcomputer in the classroom? The problem, then, is to discover the reasons for the lack of microcomputer implementation given the existence of expectations and a trained group of teachers.

In order to answer these questions and to find a solution to the problem, this study investigates the expected and actual implementation of the microcomputer in the classroom by teachers who completed a county sponsored microcomputer course. The demographic aspects of this study include age, gender, years of teaching experience, grades and subjects currently teaching, previous experience with microcomputers, the date of the teachers microcomputer course and type of machine used, and reasons participants gave for taking the county microcomputer course. Further, this study probed the expectations of microcomputer implementation after completion of a county sponsored microcomputer inservice course. Levels of implementation were also explored, as well as, obstacles to implementation and the strategies used to overcome the obstructions in order for actual implementation to take place was explored.

Throughout this study demographic characteristics were addressed to discover their relationship to the outcome. In addition, expectations and implementation were assessed across time through the exploration of two separate surveys, 1985 and 1992.

To date no studies have touched upon the expectations of users and the relationship between expectations and actual implementation of the microcomputer by the users, hence the need for this study. In addition, none have studied this innovation during two separate survey years. Such an exploration makes it possible to study change and therefore further theory and future research. This study addressed the following issues:

1. Who took general microcomputer literacy courses? What differences were there between those sampled during the two time periods (Because data were collected in similar format for people who had taken similar courses in the two time periods, it was possible to use the second period to confirm or disconfirm findings from the first period)? Did variables such as teacher characteristics, level of teaching, years of experience, previous microcomputer experience, age, sex, and reasons for taking the county microcomputer course change over time? If so, in what ways?

2. Was there any difference in teacher expectation of microcomputer usage across time?

3. Was there any difference in implementation of microcomputer usage across time?

4. After completing a county sponsored inservice microcomputer course, was there a difference between the expected and implemented tasks (classroom management, instruction about microcomputers, instruction about a specific subject area, and evaluation of activities related to the microcomputer)? If so, in what areas were there differences?

5. What obstacles did teachers find when trying to implement certain tasks such as management, instruction, and evaluation using the microcomputer?

6. What problem solving about microcomputer use occurred? Did teachers demonstrate strategies to overcome problems in implementing microcomputer tasks in the classroom?

7. What was the relationship between the obstacles encountered in both time periods studied and the amount of implementation?

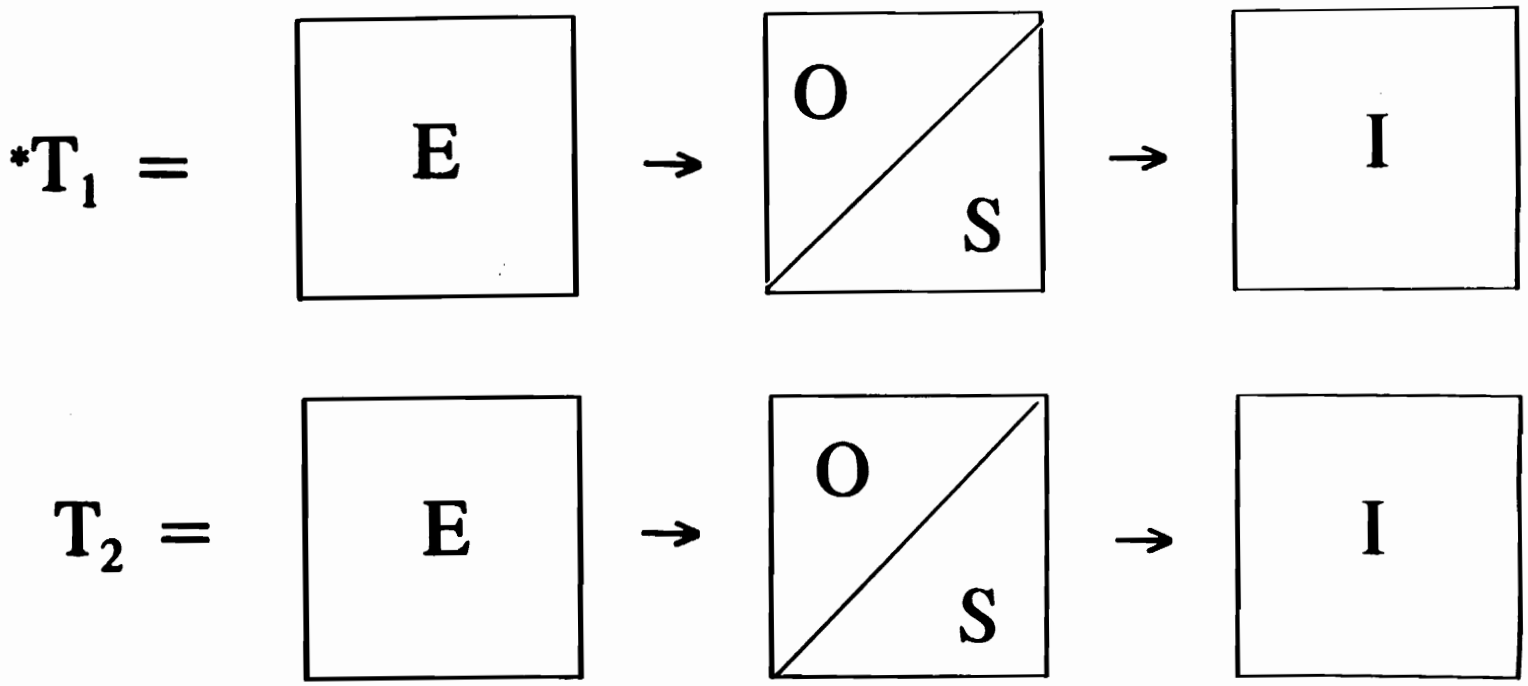
8. What was the relationship between the problem solving strategies used and the amount of implementation accomplished?

The relationship of expectations to implement to actual implementation is represented schematically in Figure 1.

Rationale

The rationale for this study centers on the need for further investigation of the expectations to implement tasks using the microcomputer by teachers who have taken a microcomputer course and their actual implementation (in other words, actions as opposed to attitudes toward innovation). On the theoretical level, the rationale for this study involves the need to ascertain the relationship of problem solving to expectations.

Many studies have analyzed innovation and change (Goens & Clovis, 1992; Miles, Saxl, and Lieberman 1986;), adoption of an innovation (Hall, 1992), resistance to change (Graczyk, 1988; Hannafin and Savenye 1993). Others have concentrated on implementation (Mathison, 1992; Reep & Grier, 1992) and expectations for success (Khamis, 1992). As a means to accomplish success of expectations leading to implementation, studies have also explored inservice education (Mathison, 1992;) and



*T1 = Time 1 (First) survey year 1985; T2 = Time 2 (Second) survey year 1992:
E = Expectations; O = Obstacles; S = Strategies; I = Implementation

FIGURE 1.

EXPECTED RELATIONSHIP OF EXPECTATIONS TO IMPLEMENT TO ACTUAL IMPLEMENTATION

inservice as it relates to technology (Bailey, 1990; Byers, 1992). Still others have more specifically centered on microcomputers as an innovation (Trembley, 1992) and in the educational setting (Bond, 1988; Hall, 1992; Wedman, 1988). The specific areas that have been explored so far include diffusion and state of the art (Hall, 1992), and teacher attitudes toward microcomputers (Hancock, 1991).

Repeated searches of ERIC and other sources didn't find studies that have focused on expectations and actual implementation of the school system and the teachers including teachers' reactions to technology and change in general, prior to implementation concerning microcomputers.

Also, while a few studies have explored resistance or obstacles to implementation, none, according to searches in ERIC and other sources, have explored obstacles and strategies used to overcome these obstacles in using the microcomputer by using problem solving as a means or reaction to change. Nor have any studies explored expectations and implementation in two separate survey years (1985 and 1992). Thus, the general field of innovation and change, expectation and implementation, inservice training, and microcomputers have been explored. However, teacher and school system expectations as related to the implementation of the microcomputer with a secondary emphasis on obstacles and overcoming strategies in two separate survey years (1985 and 1992) has not been studied to date. This step logically follows and needs to be researched for the benefit of the educational world and those outside and related to it.

Significance of Study

The significance of the study, then, lies in its contribution to the literature on expectation, expectation and implementation, innovation implementation obstacles, innovation implementation strategies, change in general, and problem solving as a means or reaction to change, as each topic relates across time. As research does not exist to date concerning expectation and implementation related to problem solving in separate survey years and since no studies relate obstacles and strategies to expectations and implementation at two different times, this research is needed to expand research in these areas. Research into the expectations of teachers, their reaction to technology, and their actual implementation of the microcomputer in the classroom adds a deeper dimension to the implementation process. Not only was expectation and actual implementation explored, but also obstacles and strategies were studied to determine what possible obstacles were encountered and what strategies were used to overcome such obstacles in the innovation process. In addition, two levels of expectation and implementation were studied: the school system and the teacher. Finally all aspects of this study were compared during two separate survey years to ascertain whether change in expectations and implementation occurred over time.

These research results can be used by educators and the microcomputer industry alike, especially since both have such strong vested interest in this

innovation. Boards of Education and school administrators want to know how to implement microcomputers in the classroom in the most effective way, especially since public pressure and scrutiny are so strong at this time. Boards of Education also want to know if initial financial investment and application warrants continued program support. The microcomputer industry wants to sell its product and needs to know the best way to approach the educational world in order to insure sales that will be constantly regenerating. The educator's ultimate target is the child and, in turn, society. The educator must know the best and most successful way to apply the innovation so that the child will obtain the optimum benefit which will in turn hopefully improve our society which depends more and more upon technology and a technologically literate population to propel the United States into the twenty-first century and a communication interconnected world.

Assumptions, Delimitations and Limitations of The Study

The assumptions/delimitations/limitations of this study include the following:

1. Only teachers in FCPS (Fairfax County Public Schools, Fairfax County, Virginia) who have taken the microcomputer course and had already decided to accept the innovation were included in this study. They had no overriding concerns about the effects of it on students in elementary and secondary schools.

2. Only teachers in FCPS who had taken the basic microcomputer course due to a variety of voluntary and involuntary reasons from total dedication to the innovation, to curiosity, to pressure from peers and administrators were included in this study.

3. All teachers included in this study were in elementary or secondary schools in FCPS system and had taken at least one basic microcomputer course prior to each survey year on either the Atari and/or APPLE microcomputer and were taught by a variety of teachers and in a variety of environmental settings.

4. Implementation of the innovation of the microcomputer in the FCPS classroom occurred under varied human and physical circumstances.

5. This study is limited to self-report data through questionnaires and interviews and it is assumed that educators in the FCPS system were candid and forthright in their response.

6. Teachers provided their own criteria when asked, "Are you doing this task on the microcomputer?" It was enough that they thought they did.

Definition of Terms

This study proposes to examine the difference between expected and actual implementation of the microcomputer innovation in the classroom and the obstacles encountered and strategies used following a teacher inservice course about the

microcomputer. As used in this research document the following definitions are offered:

Change - any significant alteration of an existing situation; a shift or difference which occurs between time 1 and time 2, specifically the difference in classroom use of microcomputers between the years of 1985 and 1992;

Expectation - the act of looking forward to the achievement of implementation of the innovation to some degree, specifically the hoped for usage of the microcomputer in the classroom;

FCPS - Fairfax County Schools;

Implementation - those actions that cause the achievement of objectives set forth in prior policy decisions; the events that occur following the decision to adopt a specific innovation, the use of the microcomputer in the classroom;

Innovation - a practice that, when introduced, is intended to result in deviation from existing norms and procedures; an idea, concept, or tool that is introduced to an individual or group who had not previously implemented it, specifically the microcomputer;

Inservice - planned program of learning opportunities not related to the pursuit of a formal degree afforded staff members of school districts and related agencies for purposes of improving the function and performance in already held or assigned professional staff positions, specifically instruction about the microcomputer;

Microcomputer - any microcomputer which includes a central processing unit, keyboard, and display screen as an integrated unit; a relatively inexpensive, small, transportable electronic machine that has a limited memory size and which is able to perform arithmetic and logical operations in sequence and in accordance with pre-programmed instructions;

Microcomputer Literacy - instructions in the historic and present function of microcomputers in our society and specifically in our schools, and/or programming languages; in the FCPS system the BASIC language (Beginners' All-Purpose Symbolic Instructional Code) was the focus of the course;

Obstacles - Impediments that hinder actual implementation of the innovation, specifically the microcomputer in the classroom;

Strategies - Methods used to overcome obstacles to implementation of an innovation, specifically the microcomputer in the classroom.

The key elements of this study, then, include teachers who have taken a county microcomputer course during two separate survey years (1985 and 1992), their expectations to implement microcomputer usage in the classroom, their reaction to technology and change including the use of problem solving, and their actual implementation in light of obstacles and strategies used to overcome obstacles. On the practical level, the relationship between teacher expectation and implementation was represented schematically in the initial stage of this study. The teacher finishes

the course with certain expectations of implementation of the microcomputer in the classroom. In trying to do so, the teacher encounters obstacles to these expectations. When confronted with obstacles, the teacher then uses different strategies through problem solving to overcome these obstacles. When these attempted strategies are successful, the innovation of the microcomputer is actually implemented for the desired goal.

CHAPTER 2

Review of Literature

The review of literature which follows provides multiple perspectives on the implementation of a curriculum innovation. This review begins with a discussion of change and innovation in general. As the literature on expectations and implementations for change is more carefully examined, problem solving is used in relating expectations to experience and obstacles to strategies. The review continues by exploring inservice training, literature which focuses on the innovation itself, the technology of the microcomputer, and finally, the exploration of inservice training as a means of promoting technology. This chapter concludes with a series of research questions, suggested by the literature, which guided data collection and analysis.

Change and Innovation

Change and innovation are words often used interchangeably in the literature, although they are occasionally defined separately. Where the terms are differentiated, innovation is usually referred to as a specific idea, procedure or practice which is new to the user (Knupfer, 1986). Change is viewed more generally as the impact on the person of doing something in a different way or, as Goens and Clovis (1992) states when addressing change in connection with microcomputer usage, "the technical

components connecting with the human elements". The difference is that one follows the other, with innovation as the cause, and change as the result. However, these terms are usually used interchangeably, meaning new idea, procedure, or practice. The amount of literature on change and innovation is enormous. Some extensive literature reviews have identified several thousand articles and reports on various aspects of change and innovation in organizations (Knupfer, 1986). Historically, researchers on planned change have come from disciplines outside of education, usually from business and the field of organizational theory. Currently, business continues to advance in planned change methods and today, for example, encourages educators to change educational focus to emphasize all forms of information technology (Fitzsimmons, 1994), using business change methods. Studies of the change methods in other organizations have then been applied to education. Before examination of some of the theories underlying their efforts, a review of the kinds of change and activities of change will be helpful.

Changes or innovations are categorized in the literature according to degree of impact on the user and/or the system. Miles, Saxl, & Lieberman (1986) delineates three kinds of change: (1) "maintenance" which "accepts the system as given" and focuses on "fixing, tuning and facilitating;" (2) "marginal" which entails "substitution or addition of elements in the system" and typifies most school change. Beaton (1985), and Miles, Saxl, & Lieberman (1986) include among such elements change agents, people previously trained in the proposed innovation, who enthusiastically

recruit and teach others about the innovation or proposed new direction or change in the school; and, (3) "core change" which involves "alteration in the structure and functioning of the system itself" (Miles, Saxl, & Lieberman 1986).

Another approach to viewing kinds of change is offered by Mahmood and Hirt (1992) who differentiate between structural changes which "are encouraged by upper management" and behavioral changes which require learning of new roles "through training and attitude adjustment." Goens and Clovis (1992) add that change is the "transformation connecting technical components with human elements to create fundamental changes in the ways people perceive, think, and behave."

The successive activities which constitute change process have been titled in a variety of ways, but essentially can be grouped into three stages. Initiation, which represents the beginning, includes the introduction of the change and can be presented in a variety of ways from administrative fiat to teacher suggestion (Moskowitz & Berman, 1985). Resistance can also be a part of the reaction to initiation and can occur on both the system and teacher level (Graczyk, 1988). Hannafin and Savenye observed in 1993 that resistance to change happens when an innovation is perceived as causing more problems than it solves or when money spent on an innovation is thought to be out of proportion to the actual benefits of its use. This resistance to change must be overcome during the initiation stage and the implementation process if change is to take place.

The second stage of the change process is implementation. The definition of

this word in the field of education is difficult as it depends upon one's opinion of successful change. In 1991, Brennan stated one view of change, that of adapting the individual to the innovation through strategic long range planning, comprehensive training and staff development. This view of implementation, however, does not take into account the interaction of the user and the innovation and the need for problem solving skills and techniques. This opinion about change was described by Cicchielle and Baecher in 1990, as the personal dimension of the change process. This view holds that a change model assessing the person level orientation to an innovation with problem solving instruction and examples is the most promising approach to complete and on-going change. Both opinions of implementation address the eventual institutionalization of change in the system.

The third stage of change relates to incorporation (also called institutionalization, or stabilization) of the innovation into the system. Institutionalization happens when the innovation is common in the daily operations of the system with ongoing evaluation for improvement (Knupfer, 1986). Ayers noted in 1992 that both theory and cooperative planning are crucial to educational improvement and institutionalization. This stage involves decisions about cost/benefit issues on a broad range of topics. Finally, as Lacampagne (1993) states, lasting change happens only when there is strong, broad support.

Thus, change can be defined, separated into kinds and stages, divided into activities and be related to theory and practice. However, in most of the research

change is not related extensively to the system organization. As Hall (1992) states, "a more holistic approach is needed" in which the system is included as well. Many believe school organizational factors, or the system in which the innovation is introduced, to be a significant predictor of change success. This system involves not only the physical setting, staff and regularities of school life, but also the historical aspect, political situation and the social context in which the school functions (Hall, 1992). This study includes this dimension.

Since schools are organizations in need of the results of research, some researchers offer ideas about school characteristics in relationship to change. Moskowitz and Berman (1985) note that often administrators treat change like magic in order to gain publicity and thus rush into change by administrative fiat rather than developing broad policy and administrative procedures, acting on committee recommendations, and establishing a microcomputer program evaluation. Finn (1992) writes that often system goals are expressed in general terms in order to satisfy various constituencies, which reinforces the status quo and reduces incentives to innovate, or gives a lack of incentive to change. Such political, social and economic influences on public schools, can also determine the nature and course of innovations. As Apple (1992) recently states "education has increasingly become dominated by economic interest with increased emphasis on making education an economic product." Lastly, Goodlad (1992) points to permeability to environment which is due to schools being subject to local lay control. Such vulnerability causes schools to

decrease visibility and, as a result, avoid actions such as innovations which might provoke criticism.

Thus, researchers in education have explored kinds and activities of change, but have not emphasized implementation, especially as it relates to the school setting. So far, researchers have discovered that a significant predictor of change success is school organizational factors, but researchers have not pursued change research into the field where selected school organizational factors such as equipment, school aides, and central office support directly impact the adoption and implementation of an innovation. This study explored implementation in relationship to the change process in the school setting on both the system and teacher levels in two separate survey years. In addition, researchers have realized that teacher attitudes toward change, including expectations, have a very real bearing on change implementation. Therefore, the present study builds on existing theory which is in need of field studies that involve change expectations and implementation in the school setting.

Technology Change

The way in which technology has been introduced into the educational world has changed over the years. Graczyk (1988) chronicles changes in technology introductions in relation to national trends. In the 1960's, researchers predicted the trend toward the increased use of the electronic media in the humanities and did not

foresee any problems between the humanistics and the electronics industry or the resistance of teachers and administrators to instructional innovation. During the 1970's forecasters did not anticipate shifts in the economy and the values of the young. In the 1980's, electronics was in the midst of the conservative mood of the country, censorship, the back to basics movement, civil rights and women's movements and the reduction of federal funding.

Now, in the 1990's, if the traditional classroom continues to give way to electronics, it will depend upon a healthy economy, the willingness of citizens to provide financial and moral support to public education, and the quality of teacher preservice and inservice programs. Hopefully, education in schools will not become irrelevant. This view is echoed by business and government (Fitzsimmons, 1994), as the current communications age learning system (media/information sources with equal influence by home, church, and school) differs so much from the industrial age learning system (home, school, church with none or little media/information sources). In light of this view, educators must be aware of the best way to introduce the microcomputer into the classroom. Isherwood (1990) gives the following advice to technology innovators: do not oversell the value and usefulness of technology, do not try to use electronics as a quick fix to various school problems, do not try to change everything at once, acquaint the total staff with microcomputer operation, understand the system, and involve the appropriate staff in the choice of the equipment and training. As the administration follows this advice when introducing the

microcomputer, what are administrator and staff initial expectations? This question and other aspects will be discussed in more detail in the following section.

Expectations

What is the expectation of success when investigating change, innovation and technology? Knupfer (1986) notes that teachers approach microcomputer usage with a wide variety of expectations. Each teacher is hoping for a certain level of success which determines performance and subsequent use of the microcomputer. Khamis (1992) notes that "often teachers will be interested or challenged but have reservations about their abilities". The research in this area encompasses achievement or in other words, success motivation. Implications for the present study revolve around the fact that teachers who chose to buy into the innovation, the microcomputer, volunteered for the inservice training. They expected to be successful in various kinds of implementation, such as instructional use or management use, and began the problem solving process connected with the implementation of this new innovation by becoming involved when the opportunity was offered. Problem solving, then, was connected to expectations by providing the means to attain the reality of the expectation.

Khamis (1992) also notes that expectation of success reflects what individuals think they can do in a given situation including how hard they are willing to try.

Brennan (1991) states that if the situation or environment created by the system for the teacher includes long range planning, comprehensive training and staff development with an adequate supply of equipment, everyone will experience an increased involvement in integrating microcomputers into classroom instruction and a decrease in teacher technophobia. Thus, not only teacher and system expectations for success are factors, but the environment is also critical when examining expectations and the degree of success. When examining expectation, this study touches on the reasons teachers decided to enroll in the microcomputer inservice training and what tasks they thought that they might implement in the classroom using the microcomputer, assuming they would have microcomputers and other support to access. The study also explores the motivational factor, which includes individual intention and exertion, in other words, why do certain people take general microcomputer literacy courses. This is examined in the problem solving approach used by the system and teachers in attempting implementation and in the reasons teachers volunteered to take the inservice course (e.g., curiosity, familiarity, hoping to implement in the classroom, and being dedicated to microcomputer use in the schools). Although research has investigated ability and motivational factors, it has not linked these attributes with expectations and implementation. The literature has also not related expectation to problem solving as a means to implementation.

Implementation

Early researchers in the Rand Study, Berman and McLaughlin (1977) defined implementation as an on-going organizational process implying interactions between project and setting, progressing through different levels of use and stages of teacher concern.

The Rand Study, Berman and McLaughlin (1977) also acknowledged that a problem solving orientation on the part of the users, with diagnosis included as an ongoing process, seems to be vital. Reep and Greer (1992) also noted that teachers need to be a part of a professional unit extending beyond the classroom with administrators rethinking their traditional decision making and problem solving strategies.

Hayes (1991) stated that there are many stages to problem solving. These stages intertwine, double back and often lead in new directions. Often the most difficult task is to define the actual question. After much thinking and discussion, the problem or question is defined and may continue to be redefined during the process of problem solving. When a question or problem is identified, then a solution is needed. As solutions are offered, the problem is further understood and expanded. When a solution is chosen, then a plan is created. In turn this plan sheds new light on the problem and other possible solutions. When problem solving is used in the change process, it is not always possible to control the directions of change, which is another

part of the problem solving process. Problem solving, then, is an ever evolving, necessary process if a question or problem is to be solved.

When applying the problem solving process to implementation an awareness of the three stages of implementation is important. These three stages of initiation, provision (often called implementation) and incorporation were discussed earlier in the change and innovation section. During the initiation phase, planning, commitment, resources, and support mobilized affect implementation effectiveness. The implementation phase consists of mutual adaptation between the project design and the organizational setting of the school. The innovation's future is determined by economic, political, and organizational pressures and constraints within the local setting (Rand study, Berman & McLaughlin, 1977).

Important for this study are the Rand findings regarding the factors which influence the outcomes of the innovations and their chances of success. These include success perceived by teachers in terms of goals achieved, and difficulty of implementation reported by teachers.

Cicchelli and Baecher (1990) noted that systems must be aware of the personal dimension of the change process and teacher concern about using microcomputers in the classroom when considering microcomputer implementation. They added that in order for teachers to perceive success in terms of goals achieved, an implementation change model assessing the person-level orientation to an innovation is a promising approach to inservice training. In his examination of the factors affecting project

outcomes, Khamis (1992) comments "a supportive environment is one of the essentials in determining the successful implementation of microcomputers in classroom learning." Strategic long range planning, comprehensive training and staff development are Brennan's (1991) concerns.

Other aspects, such as keying of staff training to the local setting and local material development, are seen to be crucial (Mathison, 1992). In addition, Beaton in 1985 and Reep and Grier in 1992 viewed the need to consider potential obstacles, to provide feedback mechanisms; coordinate efforts, attitudes and knowledge of the administration, principal and staff; provide support during stressful times; inform staff of potential obstacles, to provide for teacher retraining and resocialization; develop an overall strategy for change and provide strong administrative leadership and commitment, perhaps a key feature.

In the discussion of the implementation process the roles of linking agents have also been described. Linkage agents are personnel brought in from outside the school system who, through their professional expertise, assist users in implementing an innovation. Many times linkage agents come from universities and educational research organizations and are used to bridge the gap between initiators of an innovation and actual implementors. Sometimes resistance appears on the part of the implementors toward the initiator, so while consultants are important in facilitating change it appears necessary for the implementors or teachers to have a larger role in the implementation process (McKeown, 1990). The present study is based on the role

of heightened teacher involvement in the implementation process as they attempt to problem solve.

Recently Goodlad (1992) comments on the local decisions and choices by noting the two current divergent reform movements in the U.S.: the political America 2000 which ties national interest, international competitiveness, and corporate health; and, the "grassroots movements" which aim to decentralize authority, establish upgraded schools and improve institutions. Both impact on change and related strategies.

In summary, the development of an implementation strategy which could result in change in the classroom practice of teachers has many factors. Aspects of implementation effectiveness include: (1) characteristics of innovation, including its scope and complexity; (2) characteristics of local leadership, including the principal's support, superintendent's support, and project director's expertise; and (3) support strategies, including participation in decision-making, material development, inservice training, classroom assistance, problem solving/feedback mechanisms, and resource support in the provision of sufficient time for implementation activities to occur.

Thus, implementation is likely to be greater if fewer obstacles occur and, where needed, appropriate problem solving strategies are used in order to make expectations a reality. Yet the literature has little direct information on the relationship between expectations, implementation, obstacles, and strategies.

Inservice Training

Before focusing on the innovation of the microcomputer itself, one more area of research must be explored, that of inservice training. As previously stated in the innovation, change, and implementation literature, teacher training is a vital factor in the continuation of planned change. The term "inservice education" is not universally acceptable to those who write about the topic. The choice of wording seems to depend upon one's viewpoint. Those who aim toward achieving wider acceptance of teaching as a profession tend to favor the term "professional development." Those who are working toward unionization of teachers seem to prefer "personal development," while those with an administrative viewpoint may be concerned with "staff development." Whatever the term one may prefer, the fact is that the expression "inservice education" seems to cover the entire field of research on the topic and will be used in this review.

Byers (1992) describes inservice education as the continuing education of employed teachers and continues by stating that the success of teachers in improving their microcomputer skills suggests that inservice training is essential. For these reasons, he states, it is necessary to conduct considerable retraining and renewal of staff. He also notes that inservice training is an effective strategy to successfully implement an innovation, the microcomputer. Miles, Saxl, and Lieberman (1986) submit that if curriculum improvements are to be effective they must ultimately be

implemented where the students are, in the classrooms and laboratories of the teachers. What happens in the classroom, what the teacher does, ultimately determines the effectiveness of any curriculum improvement effort. Inservice education, therefore, is identified as a means by which innovation is passed on to the members of a profession and the instructors, the main users of these innovations. Mathison (1992) continues this thought by stating that the inservice education program should adopt an explicit standard for programs so that teacher needs and differences are taken into account in efforts to change educational practices.

A review of the literature on inservice education results in several research studies which provide a rich background of information from which effectiveness of inservice education can be inferred. They conclude that the literature has been concerned with what there is in programs rather than asking why and how programs succeed or fail. They feel that the process of inservice education has been ignored and the emphasis has been on the content in inservice programs.

A number of investigators working independently have derived what they assert to be the qualities of inservice education that are responded to positively by teachers and those qualities that produce negative responses (Byers, 1992; Ellis, 1992; Mathison, 1992). Their conclusions include: programs should be school based rather than university based; programs should not be one-shot experiences; programs should be planned and participated in jointly by teachers and administrators; programs should have direct application to the daily work of the teacher; programs should allow for

active staff participation; programs should provide for opportunities for teachers to interact with each other; programs should be developmental rather than deficit in orientation; and, programs should offer intrinsic rewards.

Thus, research has noted that when introducing an innovation into a school system, teacher inservice training is essential for implementation, as in reality teachers determine how well innovations are presented in the classroom. Research also states that a system's inservice must meet the needs of the teacher in order to be successful and for the desired change to take place. In this study, inservice education is seen in the context of the school and the system itself by identifying teachers who have completed a county sponsored microcomputer inservice course in order to implement the use of an innovation, the microcomputer, in the classroom. This study explores the expectations to implement the use of the microcomputer in the classroom and the actual implementation, as well as the obstacles encountered and the problem solving strategies used to overcome the obstacles to that implementation.

Microcomputers

Next, a brief history of microcomputers and instruction will be outlined. Prior to 1975, educational computing was accomplished almost exclusively in medium or large microcomputer systems. The few microcomputers available were terminals linked by telephone lines to large, centrally located machines that served a variety of

users through an arrangement called "time sharing." However, the cost of terminals, communication lines, and microcomputer time was generally too much to consider microcomputers as viable classroom tools. A complete microcomputer system was packaged and displayed in April 1977. The high cost of electronic computing was no longer a primary obstacle to microcomputer use in the classroom. Easy to use, portable, and affordable were characteristics describing the new microcomputer. The Apple I, the Commodore PET (Personal Electronic Transactor) Model 2001, and the Radio Shack TRS-80 Level I microcomputer systems appeared on the market for the first time at less than $1000 (Minnesota Department of Education, 1992).

The introduction of microcomputers led educators to forecast a rapid growth in the use of educational computing, as instructional computing was by 1980 affordable at all levels of the educational establishment, and many predictions of microcomputer school purchases by schools were soon surpassed by reality (Electronic Learning, 1993). In the 1990's, microcomputers in society extended to the next dimension of the information highway including Internet, E-Mail, Gopher Traffic, and interactive programs on supermicrocomputers (Brown, 1994; Fitzsimmons, 1994; Miller, 1994; Mitchell, 1994; Lindow, 1994). Schools are beginning to imitate society by installing these new dimensions in a few classrooms and multimedia centers.

Theoretical and research based literature on microcomputers in schools, although markedly increased in the late 1980's and early 1990's, is still meager. Empirical evidence has been recorded, but the microcomputer is still a relatively new

educational tool to have been studied thoroughly. Recent research includes attitudes related to the innovation of the microcomputer, (Bond, 1988), studies evaluating improved student performance, (Wedman, 1988) enhancement of instruction through use of microcomputer tools (Minnesota State Dept. of Education, 1989), ways to make the microcomputer more user friendly (Tremblay, 1992) and reasons for the creation of national standards (Electronic Learning, 1993).

Leading from microcomputers to inservice training as it relates to technology, it is evident that in the cycle of the creation and use of an innovation, studies and advice evolved from the actual devices, hardware and software, to the possibilities and implementation of the innovation. The view held currently is that microcomputer training must be sensitive to the innovation, the perspective of education, aspects of resistance, and teacher characteristics if implementation is to be accomplished (Byers, 1992). In other words a change in emphasis from product to process learning.

Lastly, not only does inservice training about an innovation, the microcomputer, have to be cognizant of the uniqueness that this innovation brings to the learning process, but also of the following: the initial expectations, the obstacles to implementation, such as resistance; the problem solving strategies to overcome this obstacle, such as appropriate training; and teacher characteristics, as the present study explores.

Inservice Training and Technology

This review of inservice and microcomputer literature leads us to the specific reason for this study, the microcomputer, and teacher involvement in its implementation. The first part of this discussion will concern inservice training and technology change. It is not difficult to look at some of the constraints that staff and faculty feel about technological change: intimidation by the technology, bad experience with machines; unsubstantiated promises about hardware; and bias against mathematical computation. There is a sense of great inadequacy and ill-preparededness. Therefore, a program to introduce technology requires support and commitment on many levels. Constraints, resistance, the planning process and rewards must all be considered. People accept or seek innovation for a variety of reasons from a desire for intellectual growth to peer pressure (Ellis, 1992).

Mathison (1992) offers an evaluation model for inservice teacher education. This plan emphasizes: (1) an explicit standard for the program; (2) satisfaction of the teacher's need for professional experience whether teachers are risk takers or laggards; (3) appreciation of the differences among schools and teachers in efforts to change practices; (4) a longitudinal perspective; (5) and expansion of evaluation to the real world.

In light of the above current thoughts on the consideration of the teacher aspect and the evaluation side of inservice education, sometimes the decision is still made on

high with the training program mandated throughout the system, normally phased to various levels of participation or use. In other systems a highly individualistic approach is used when there is little hardware, and the organizational risk taker is willing to take a chance. Many systems use a "change agent" to accomplish inservice education and introduction of microcomputer applications (Beaton, 1985; Miles, Saxl, & Lieberman, 1986; Byers, 1992).

Thus, the field of research relevant to microcomputer inservice training includes the topics of change and innovation, expectation, implementation, inservice training, the microcomputer, and inservice training in relationship to technology. Researchers have explored kinds and activities of change and innovation and have discovered that a significant predictor of change success is school organizational factors. In the present study, support is in the form of microcomputer equipment and software, assistance and information help in the form of microcomputer aides and system expertise, and scheduling ease and access to equipment and materials. However, research has not explored adoption of an innovation through implementation of change by inservice courses, related to school organizational factors in the school setting, using the problem solving approach at both the teacher and school system level in two separate survey years.

Although expectation and motivational factors have been researched, expectations of successful innovation implementation have not been explored. The present study extends the motivational factors, which include individual intention and

exertion, into the reasons for taking a microcomputer inservice course and into the problem solving aspect of implementing expectations in the classroom on both the school system and teacher level even if obstacles to implementation exist.

Inservice training research has established that training is essential if complete change is to take place in a school setting and that teacher needs and characteristics must be considered for implementation to be completed in the classroom. This study extends this theory to include teacher expectations for innovation implementation after taking inservice training and the system level aspect of the adequacy of training when obstacles arise during attempted problem solving implementation in two separate survey years.

Thus, the study described here extends the field of research by exploring expectations in relationship to the implementation of an innovation in the classroom. It explores this topic on both the system and teacher levels. Finally, the study investigated the relationship between expectations and innovation implementation in two separate survey years.

It is in this light that this study starts with the teacher who has already taken a microcomputer course for the county and now plans to implement the innovation, the microcomputer, in the classroom. The teacher in this study has no overriding concerns about the microcomputer and expects to use it for a variety of tasks in the classroom. What happens when the teacher tries to implement the microcomputer in the classroom? What did the teacher expect to implement in the classroom? Was the

teacher able to implement all or some of the activities that he/she expected to implement? If not, what were some of the obstacles encountered? What were some of the problem solving strategies the teacher used to overcome these obstacles? Was there any change between the two survey years? These and other questions are explored in the continuation of this study.

CHAPTER 3

Methodology

This research focuses on the implementation of microcomputers by teachers who participated in a school system sponsored inservice about microcomputer use and the context in which that occurred. Further, the research centered on teacher expectations for microcomputer use, actual implementation in the classroom, obstacles encountered and problem solving strategies used to overcome these obstacles.

A sample of teachers who participated in the school system's general microcomputer inservice in 1985 and 1992 were sent a questionnaire after they completed the inservice course to discover which tasks they expected to implement and which they ultimately implemented using the microcomputers. The questionnaire listed thirty-two tasks divided into four areas: (1) Classroom Management; (2) Instruction About the Microcomputer; (3) Instruction About Subject; and, (4) Evaluation Activities. Teachers could also list the obstacles they encountered for each task, and the strategies they used for each task to overcome these obstacles.

Description of Population

Fairfax County, Virginia, located directly southwest of Washington, D. C., is a large part of the metropolitan Washington, D. C. area. The County consists of 399

square miles of lowlands and rolling hills. In 1985, 668,000 people lived in the county as compared to 858,000 in 1992. Of those residents in 1985, 89.2% were white, 5.9% were black, 3.7% were Hispanic, and 1.2% were Asian, whereas in 1992, 81.3% of the residents were white, 7.7% were black. 7.1% were Hispanic, and 3.9% were Asian. The difference in the figures obviously reflects the growth of the immigrant population during that time period. Educational levels of the population in 1985 reflected 41.8% of the residents had obtained four or more years of college. This figure increased to 54.6% by 1992. The 1985 median household income was $49,700 with per capita income at $21,600. In 1992 the median household income rose to $54,200, with per capita at $34,800.

In 1985, 35% of the land was residential, 17.3% was vacant and set aside for natural use, and 4.3% was commercial. By 1992, 44.4% was residential with 6.7% commercial and 3.8% vacant and set aside for natural use. The majority of people working in the county in both sample years were employed in the service industry. However, many people who live in the county work for the federal government or federal contractor related businesses and therefore commute to these jobs. Thus, Fairfax County ranges from newly arrived immigrants with no jobs and different levels of education to residents who are affluent, well educated, and politically active; all characterized by a metropolitan/suburban style of living.

Setting of the Study

Fairfax County Schools (FCPS) located in Fairfax, Virginia, a relatively affluent suburb of Washington, D.C., is the setting of this study. The teachers concerned in this study were first surveyed in 1985 and then again in 1992. FCPS first used microcomputers in the administrative/business departments in 1967. Between 1967 and 1980, FCPS began to use the microcomputer in the instructional program. Several different brands of microcomputers were tried and teacher training increased through these years. Government grants were also procured. By 1986, curriculum was fundamentally changed to provide for microcomputer instruction and use. Thus, microcomputers became an integral part of the FCPS instructional program during this time period. A more detailed description can be found in Appendix A.

Procedures

This study was based on interviews with school administrators at several levels, official school documents, and the results of responses to a set of questionnaires from teachers who took a Fairfax County Public School sponsored inservice microcomputer course. The procedure for this portion of the study consisted of the following steps: (1) the development of a data gathering instrument based on the current literature, conferences with appropriate and knowledgeable

individuals, and the experience of the researcher; (2) a revision of the instrument after a pilot study with public school teachers not included in this study; (3) refinement of the instrument by a panel of experts prior to use; (4) the administration of the instrument to a sample of all of the teachers who have taken a county sponsored inservice microcomputer course; (5) the organization and analysis of the data obtained; and, (6) the development of conclusions and recommendations.

This study was conducted among administrators who planned for microcomputer implementation in 1985 and in 1992 and among elementary and secondary teachers who were charged with innovation in the Fairfax County Public School system who took county sponsored courses. These included Atari BASIC microcomputer courses in 1985 and a variety of microcomputer courses that were similar to the 1985 Atari BASIC microcomputer course and who were charged with innovation implementation.

Sample

Approximately three thousand teachers took the inservice microcomputer course in 1985. Of these, 400 were sent questionnaires. These 400 were systematically selected as the sample by choosing every seventh name from a list of course completers. Of the 400 questionnaires initially distributed, 294 were returned and became the basis for the 1985 study.

In 1992, of the four thousand teachers who took the inservice microcomputer courses offered in FCPS, three thousand took courses that compared with the general microcomputer course taken by those surveyed in 1985. Of these, a comparison sample size of 100 was selected or 1 in 30. A sample size of 100 teachers was selected because these teachers took courses that were similar to the course taken by the 1985 teachers. Sixty seven of the one hundred questionnaires distributed were returned and became the basis for the 1992 study.

The questionnaire was divided into five sections: Teacher Characteristics, Classroom Management, Instruction About Microcomputer, Instruction About Subject, and Evaluation Activities. The first section, Teacher Characteristics, was included in order to determine the demographic characteristics of the teachers (See Appendix B). The other four sections of the questionnaire covered areas and activities of current microcomputer attempted and, in many cases, implemented, practices espoused in the classroom. For each broad area individual activities or tasks, eight options for microcomputer use were listed. Through knowledge of the course offered and classroom practices, as well as current readings, the "expert" panel of administrators, professors, teachers and this researcher created and refined the questionnaire instrument.

The Pilot Study

Further refinement occurred during the pilot study, which consisted of a task group of twenty Fairfax County teachers who had taken the course, but who were not included in the final survey of this study. These teachers represented a variety of grade levels and subject areas as well as different years of the course offering. This pilot study improved the validity of the instrument and an item analysis using the SPSSX reliability program, Cronbach's Alpha, was performed. The demographics section as well as the four areas of: classroom management by use of the microcomputer; instruction about the microcomputer; instruction about subject area; and, evaluation of activities related to the microcomputer as well as the column headings were not altered as a result of the pilot study (Appendix B). These column headings, which are the major and secondary concerns of this study are as follows: (1) Circle the appropriate letter (concerning demographics). (2) Did you expect to use the microcomputer to do this task? (3) Are you now doing this task using the microcomputer? (4) What obstacles have you found to doing this task using the microcomputer?, and (5) What strategies have you tried to overcome these obstacles using the microcomputer? The eight activities under each area did not need to be altered after the pilot study. The format remained the same, that of two columns of yes/no answers and two columns of open-ended format.

Data Analysis

All teachers in the sample were notified by a carefully worded letter requesting their cooperation for the study (Appendix B). These questionnaires were mailed by the researcher to the teachers with an accompanying letter defining the purpose for the requested information and a single packet of coffee to provide for their relaxation while answering the questions. One week after distribution the researcher predicted and received about a 50% return rate which provided for a start at "key punching". A follow-up letter was sent to the remaining teachers. The researcher predicted and received a further 10% return rate. After the mailing of the first follow-up letter, a second follow-up letter was sent a week later which produced an additional 7-9% return. Receipt control was operated with codes on the questionnaires, results were sent to the participants, and the non-response study design was implemented through telephone interviews. The proposed survey calendar was established over a one month period for each survey year, 1985 and 1992. The total return in 1985 was 294 out of 400 or 74%, and the total return in 1992 was 67 out of 100 or 67%. Teachers chosen for the 1992 sample had completed inservice courses similar to those courses offered in 1985. The teachers were different in each survey and presumably did not obtain training between the years 1985 and 1992.

In order to obtain information at the system level regarding the process of implementing the microcomputer for instructional purposes using problem solving as a

framework, a series of 26 interviews, 17 administrators including 6 principals and 11 technical specialists in 1985 and 9 administrators including 3 principals and 6 technical specialists in 1992, were conducted during each survey year. These interviews were conducted during phone contact and by personal face-to-face interviews in a variety of settings. Rather than present this information in a separate section, the information gained from these interviews is defused throughout the text.

Percentages of each set of teacher demographics, teachers expecting, implementing, encountering obstacles, and devising strategies were calculated for each task area. Data were described in terms of teacher demographics, expectations, implementations, obstacles, and strategies. Further, data were then analyzed by summing individual tasks into task areas. In addition, data were analyzed by number of tasks from zero to eight tasks for each task over which teachers expected to use microcomputers, implemented use, encountered obstacles in using, or devised strategies to overcome obstacles. Thus, the percentage of individual task use was calculated, as well as the percentages of teachers expecting to not use the microcomputer or use the microcomputer for anywhere from one to eight tasks within a particular area.

As a rule of thumb differences are discussed only if there is a 10% difference.

Several specific questions were dealt with in this study. The first question stated as: "Who took general microcomputer literacy courses in each of the time periods?", dealt with the demographic characteristics of the teachers. The data source

for this question was the initial section of the questionnaire, which solicited information about demographic characteristics, such as age and gender and about experience, such as prior experience in teaching and with using microcomputers. Results were calculated by frequencies and presented as simple percentages in the text. Crosstabs were also calculated on how many tasks were implemented by characteristic. This data can also be found in Appendix D.

The second question of: "Was there any difference in teacher expectation of microcomputer across time?", explored the expectations across survey years, 1985 and 1992. Within each time period, means were computed. In addition, frequencies and percentages were calculated to determine the number of tasks performed (Appendix E).

The third question, "Was there any difference in implementation of microcomputers across time?", explored the implementations across survey years, 1985 and 1992. Within each time period, means were calculated. Number of tasks were also calculated on implementation using frequencies and percentages (Appendix E).

The fourth question, "In what ways did implementations differ from expectations?", addressed the difference between the expected and actual implementation. For comparison of total expectation and implementation within the two time periods, means were calculated. Using crosstabs, expectation and implementation concerning number of tasks were computed (Appendix E).

The fifth question, "What obstacles did teachers face?", ascertained the amount and types of obstacles involved. Analytical strategies here were initially simple counts of obstacles. Later obstacles were sorted into two types, physical and support. Informal comparisons were made of the relative frequencies percentages of each type in the two time periods. Additional calculations, frequencies percentages, were made to determine the number of tasks involved with obstacles (Appendix F).

The sixth question, "What strategies did teachers employ?", ascertained the amount and types of problem solving strategies teachers used. Initial statistical techniques used were simple counts of strategies. Later, strategies were sorted into two types, school and home. Informal comparisons were made of the relative frequency percentages of each type in the two time periods. In addition some calculations were used to determine the number of tasks involved with strategies (Appendix F).

The seventh question, "How were obstacles related to implementation?", investigated the relationship between obstacles and actual implementation. The initial intent was to compute correlations, but given the relatively small number of responses for obstacles, counts were again used. Obstacles were also crosstabed with implementation (Appendix G).

Lastly, question eight, "How were strategies related to implementation?", investigated the relationship between strategies and actual implementation. The initial intent was to compute correlations, but again given the relatively small number of

responses for strategies, counts were used instead. In addition, crosstabs were calculated on strategies and implementations (Appendix G).

The development of conclusions and recommendations of this study will proceed after the analysis of the data.

CHAPTER 4

Results

This chapter presents the results of the research. It begins with a narrative description of relevant findings and continues with the answers to the questions. The study measured both anticipated and executed microcomputer use of 361 participants, 294 in 1985 and 67 in 1992, who had taken an inservice course in microcomputer usage. In addition, the study examined problem solving at the school system level and teacher level. This information is reported together as each finding and question is analyzed.

The Survey

During the 1985-1992 period of the system's experience with the creation of instruction based on microcomputer use, many teachers were aware and excited about the use of the microcomputer in the classroom. Teachers chose to take microcomputer inservice courses when the system offered the training. This study measured the expectations and classroom results of teachers during 1985 and 1992, two distinctly different times in the school system's history of microcomputer implementation. During 1985 the system was in stress with Project LITT's 32 sites and other schools and PTAs demanding equal access. In 1992, the system had

regrouped and approached the problem with additional training, support, equipment and software for all of the schools, with a few special performance sites. In 1985, 400 questionnaires were sent to teachers who had taken an inservice course; 294 responded. In 1992, 100 questionnaires were sent, and 67 teachers responded.

They were asked if they had expected to implement various tasks learned in the course and if they had actually implemented these tasks using the microcomputer. Tasks were divided into four areas: Classroom Management; Instruction About the Microcomputer; Instruction About the Teacher's Subject Area; and, Evaluation Activities. For each area there were eight specific tasks listed. Teachers were also asked to list obstacles encountered in trying to use the microcomputer and possible strategies used to overcome the obstacles to using the microcomputers to implement the specified tasks.

This chapter is divided into eight sections: (1) demographics; (2) expectations; (3) implementations; (4) expectations as compared to implementations; (5) obstacles; (6) strategies; (7) obstacles' effect on implementations; and, (8) strategies' effect on implementation. For each sequence, the two time periods, 1985 and 1992, are contrasted.

Demographics

This study examined the relationship between teacher characteristics and key

attributes of microcomputer training and use. Characteristics of teachers and their microcomputer experience, such as: subject responsibility, teaching experience, sex, age, previous microcomputer experience, prior use in the classroom, reasons for taking the FCPS inservice, time lapse between inservice course and classroom implementation for various functions were examined in this study. (Question 1).

Characteristics Tables

Tables 1-3 show some major differences in characteristics of teachers at the two different times included in this study. In 1985, Table 1, teachers who participated in the county inservice on microcomputers taught primarily math and English. In 1992, however, participants taught primarily math and special education. In both 1985 and 1992, most teachers participating in the inservice training had taught between 11 and 20 years with the remaining teaching over 20 years. In each year studied, female teachers dominated the survey. Accounting for 68.4% of the participants included in 1985 as opposed to 85.1% in 1992. Most teachers in the inservice course were between the ages of 30 and 49 years in 1985, whereas in 1992, most were between the ages of 40 and 59. This trend was also true of the county as a whole.

The greatest contrasts between the earlier and later years of the study were in teachers' previous microcomputer experience in post training use, Table 2. In 1985,

TABLE 1

A COMPARISON OF CHARACTERISTICS OF TEACHERS IN FCPS INSERVICE TRAINING BY YEARS STUDIED

A. SUBJECT AND EXPERIENCE			
1985		**1992**	
Subject	**%**	**Subject**	**%**
Math	26.2	Math	25.4
English	12.2	English	4.5
Science	9.2	Science	4.5
Social Studies	8.5	Social Studies	3.0
Business	6.1	Business	6.0
Special Education	4.8	Special Education	13.4
Art	4.1	Art	11.9
All others	28.9	All Others	31.3
	100.0		100.0
Years Experience	**%**	**Years Experience**	**%**
8 - 10	13.9	8 - 10	17.9
11 - 20	44.9	11 - 20	46.3
Over 20	26.5	Over 20	22.4
All Others	14.7	All Others	13.4
	100.0		100.0
B. GENDER AND AGE			
Gender	**%**	**Gender**	**%**
Female	68.4	Female	85.1
Male	31.6	Male	14.9
	100.0		100.0
Age	**%**	**Age**	**%**
30 - 39	31.3	30 - 39	20.9
40 - 49	39.1	40 - 49	34.3
50 - 59	20.7	50 - 59	34.3
All Others	8.9	All Others	10.5
	100.0		100.0

TABLE 2

A COMPARISON OF PARTICIPATING TEACHERS' PREVIOUS EXPERIENCE WITH MICROCOMPUTERS BY YEARS STUDIED

A. COMPUTER WORKSHOPS

1985		1992	
Previous Experience	**%**	**Previous Experience**	**%**
None	54.8	None	32.2
Little	20.7	Little	29.9
Some	9.2	Some	19.4
Much	1.4	Much	11.9
No Response	13.9	No Response	6.0
	100.0		100.0

B. COMPUTER COURSES

Previous Experience	**%**	**Previous Experience**	**%**
None	53.1	None	6.0
Little	16.7	Little	17.9
Some	17.0	Some	38.8
Much	4.1	Much	19.4
No Response	9.1	No Response	17.9
	100.0		100.0

C. COMPUTER HOME USE

Previous Experience	**%**	**Previous Experience**	**%**
None	63.3	None	13.4
Little	9.9	Little	13.4
Some	10.2	Some	37.3
Much	1.6	Much	26.9
No Response	15.0	No Response	9.0
	100.0		100.0

D. COMPUTER WORK USE

Previous Experience	**%**	**Previous Experience**	**%**
None	62.2	None	7.5
Little	7.8	Little	7.5
Some	7.5	Some	43.3
Much	4.1	Much	31.3
No Response	18.4	No Response	10.4
	100.0		100.0

E. COMPUTER SCHOOL USE

Previous Experience	**%**	**Previous Experience**	**%**
None	59.5	None	6.2
Little	10.5	Little	13.3
Some	10.2	Some	34.3
Much	3.4	Much	35.8
No Response	16.4	No Response	10.4
	100.0		100.0

a majority of teachers had no previous experience with microcomputers and others had little, especially in direct use of the microcomputer. By 1992, however, a majority of teachers had either a little or some experience with microcomputers prior to their participation in the inservice course, with the least experience obtained in microcomputer workshops.

In 1985 few teachers had experience with the microcomputer through workshops, courses, home use, or school use; in 1992 the majority of teachers had some microcomputer use prior to the inservice course and much experience in school use. This was probably due to the school system's procurement of microcomputers and software by 1992 and the teachers' greater familiarity with microcomputers in general.

In both 1985 and 1992, Table 3, most teachers voluntarily took the FCPS course. While most expected to use microcomputers in the classroom, Figure 2, shows that the majority of 1985 respondents did not actually use microcomputers in the classroom. However, the majority of 1992 respondents implemented use or microcomputer use of tasks within three months of taking the course.

Further implementation information can be gained from the results of the amount of implementation compared to each demographic characteristic between 1985 and 1992 (Appendix D). Briefly, in general, the demographic variables when compared to task implementation did change over time. A higher number of tasks were implemented in 1992. Math teachers implemented the most tasks in 1985, while

TABLE 3

A COMPARISON OF PARTICIPATING TEACHERS' REASONS FOR TAKING INSERVICE MICROCOMPUTER COURSES

INITIAL REASONS			
1985*		1992+	
Reason	**%**	**Reason**	**%**
Voluntary	57.5	Voluntary	62.7
Recertification	15.6	Recertification	14.8
Required to Implement	10.7	Required to Implement	4.5
Involuntary	1.0	Involuntary	3.0
No Response	15.2	No Response	15.0

* Of all 294 Teachers Responding
+ Of all 67 Teachers Responding

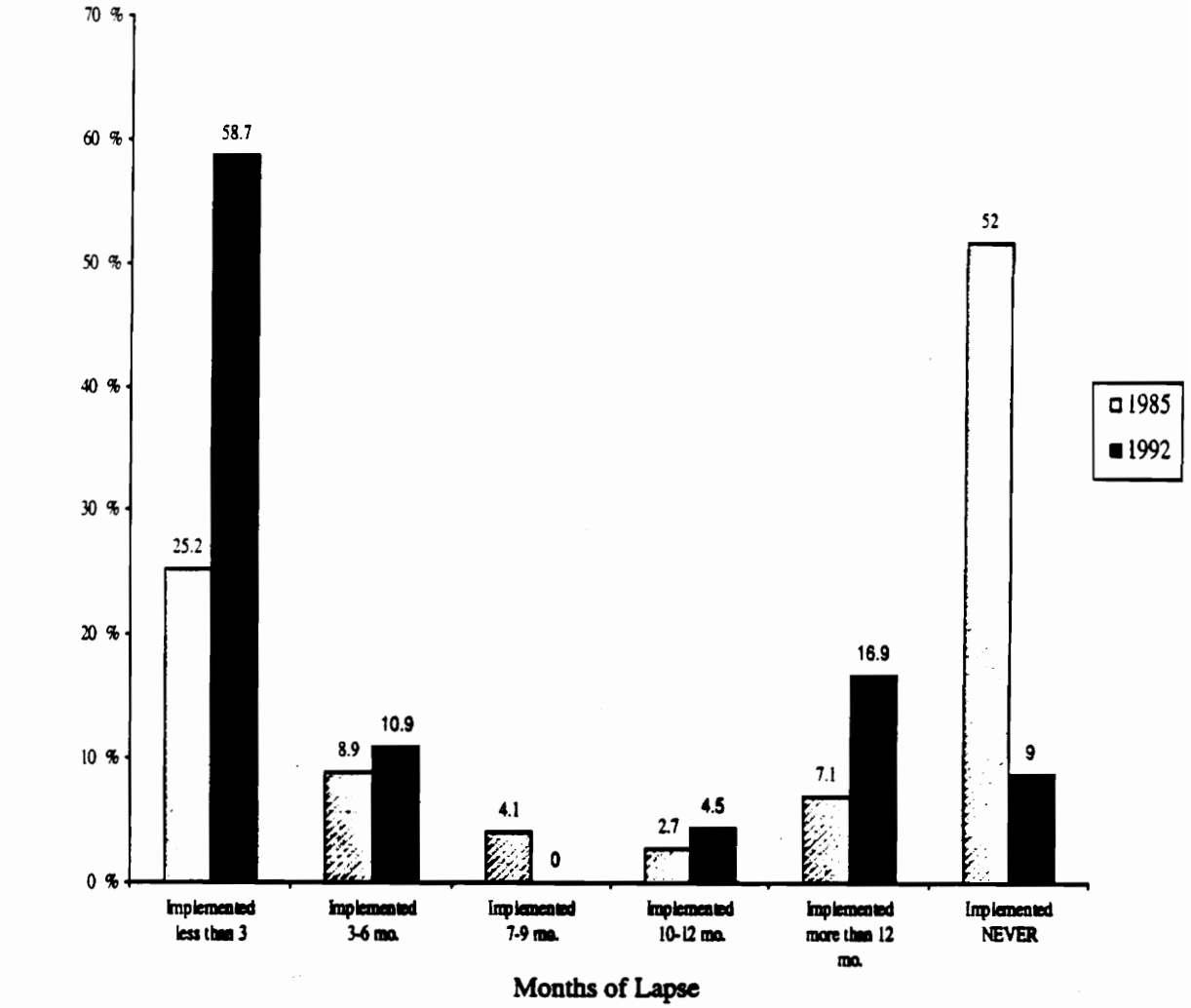


FIGURE 2.

MONTHS LAPSE BETWEEN INSERVICE COURSE AND FIRST IMPLEMENTATION

English teachers implemented a higher number of tasks in 1992. Teachers with less teaching experience implemented more in 1985, while those with 3-7 and over 20 years experience implemented more in 1992. In 1985, females implemented use at a greater percentage than males, but by 1992 a greater percentage of males implemented use even though there were a greater percentage of females in the survey and in the county. In 1985, all ages implemented the same number of tasks, but by 1992, those teachers in their twenties, forties and fifties implemented the most tasks. Teachers with previous microcomputer use before taking the inservice course, implemented use more in 1992 than in 1985, especially those with work use and school use. Teachers who took the course voluntarily increased the amount of implemented tasks from 1985 to 1992. Finally, the time lapse between the course and implementation was shorter in 1992 than in 1985, with most implementing 11-20 tasks in 1992 (Appendix D).

Expectations

Expectations are organized in terms of four areas of microcomputer usage: classroom management, instruction about microcomputers, instruction about subject, and evaluation activities. Within each area there is first discussion about the relative number of tasks that teachers expected to be able to carry out and then discussion about 8 specific tasks by which each of 4 areas was indexed.

Classroom Management

Tables of the number of tasks expected or completed by teachers in each year which are related to this section and to the following sections can be found in Appendix E. In addition, some tables include the number of teachers expecting to implement or who had implemented a specific number of tasks.

Different teachers expected to use the microcomputer for a variety of tasks in the classroom in both 1985 and 1992. Table 4 shows that for both years teachers expected to use the microcomputer, in Classroom Management, mostly for basic computational recording activities in daily classroom life. For example, over one-third of teachers in 1985, and over 40% in 1992 expected to use the microcomputer for two tasks: (1) record keeping; and (2) average student grades. Since these computational tasks can be simplified greatly for teachers by using the manipulative capabilities of the microcomputer, teachers saw the advantages of using the microcomputer, and expected to use the microcomputer to facilitate their tasks.

Teachers listed cataloging instructional materials as the third most likely task for which they expected to use the microcomputer in classroom management in both 1985 and 1992. The microcomputer offers the capability of easily organizing, rearranging, updating, and printing lists of resources derived from many origins. Teachers cited keeping schedules of classroom activities as another task for which they expected to use microcomputers for both 1985 and 1992. In 1992 their

TABLE 4

A COMPARISON OF TEACHERS EXPECTING TO USE COMPUTERS IN CLASSROOM MANAGEMENT ACROSS TIME

% IN 1985*	TASKS	% IN 1992*
36	Average grades	42
34	Recording student grades	42
17	Cataloging instructional materials	28
11	Keeping schedule of activities	28
10	Reporting parent contact	25
10	Recording attendance	24
9	Checking school supplies	13
6	Recording disciplinary action	19

* Of all 294 Teachers Responding
+ Of all 67 Teachers Responding

expectations for this item more than doubled over the previous period, probably due to the enhanced capabilities of the microcomputer for reorganizing and printing. Even though teachers use lesson plan books to list lessons and other daily activities, the microcomputer simplifies the recopying and last minute changes which were otherwise inconvenient for the teacher.

As indicated in Table 4, teachers' expectations for using microcomputers for at least four activities--keeping schedule of activities, reporting parent contact, recording attendance and recording disciplinary actions--more than doubled from 1985 to 1992. This resulted when more equipment and software were made available and thereby extended the possibilities of other tasks being included in teacher expectations. It is interesting to note that some 1985 expectations were 10 percent or lower: those of reporting parent contact, recording attendance, checking school supplies, and recording disciplinary actions. These are the lowest figures in the entire expectation section of the survey, indicating that these tasks were apparently never ones that teachers expected to use a microcomputer to fulfill or never did themselves.

Instruction About Microcomputer

The Instruction About the Microcomputer (Table 5) ranks the eight tasks for which teachers expected to use microcomputers to teach specifically about microcomputer use. Again overall expectations increased over time as more

TABLE 5

A COMPARISON OF TEACHERS EXPECTING TO USE COMPUTERS IN INSTRUCTION ABOUT MICROCOMPUTERS ACROSS TIME

% IN 1985*	TASKS	% IN 1992+
31	Microcomputer vocabulary	49
31	Mechanics of programming	39
31	Write computer programs	38
25	Use of different software	52
20	Applications in careers	31
16	Selection of software	31
15	Teaching social impact of microcomputers	25
14	Teaching history of microcomputers	21

* Of all 294 Teachers Responding
+ Of all 67 Teachers Responding

microcomputers and software were acquired for teacher use. Interestingly enough, teachers most often expected to use microcomputers for the same four tasks in each survey year. In the earlier year, between one-fourth and one-third of teachers expected to use microcomputers to teach microcomputer vocabulary, mechanics of programming, writing programs and use of different software. In the later year, over one third to one half of the teachers expected to use the microcomputer for these tasks. Fully twice as many teachers in 1992 as in 1985 expected to use the microcomputer to teach the use of different types of software and to select different software. Realistically, in the later year, many more commercial programs were suitable for classroom use. In addition, the school system had regrouped, using the problem solving process, to purchase software for all schools to use. Teachers in both years, a few more in the later year, also expected to use the microcomputer for teaching vocabulary and mechanics of programming. These tasks enabled teachers to use the technology for teaching about technology.

Teachers in both surveyed years expected to write microcomputer programs which were subject specific, like social studies and English. Teachers had relatively little expectation of using the microcomputer to teach the history, social impact and career relationship of the microcomputer in either 1985 or 1992. Since the POS (Program of Studies) did not include these objectives and is very demanding and closely monitored as to the specified objectives taught, teachers barely have enough time to cover all that is required, let alone anything additional.

Instruction About Subject

Table 6 ranks teacher expectations for using the microcomputer to teach about their own subject area. As before, expectations in this area increased greatly between the two survey years, probably reflecting real differences in technical materials available to teachers in 1992 and the system problem solving by regrouping, or in other words, analyzing preliminary results and redirecting efforts. In 1985, limited equipment was available and few useable software programs were adapted for classroom use. By 1992, classroom and microcomputer labs were in place in every school and much more software was available and appropriate for classroom use.

As Table 6 shows, three quarters of the teachers expected to create quizzes and tests and to use single purpose programs in 1992. However, in 1985 not quite half of the teachers had expected to use the microcomputer for these tasks. The magnitude of the difference is important. In 1992, single purpose software programs had already been created. By that year, teachers also thought that developing games for learning specific subject matter was possible for classroom use. Around a third of the teachers in 1985 and almost half of the teachers in 1992 also expected to teach their subject through the creation of drill and practice programs, development of games and tutorial programs. The percentage of teachers expecting to use computers for simulation programs almost doubled between 1985 and 1992. This increase was probably due to both the availability of inservice training during each survey year and

TABLE 6

A COMPARISON OF TEACHERS EXPECTING TO USE COMPUTERS IN INSTRUCTION ABOUT SUBJECT ACROSS TIME

% IN 1985*	TASKS	% IN 1992+
47	Using single purpose programs	75
41	Creating quizzes and test	78
37	Creating drill and practice programs	42
31	Creating games	48
30	Creating tutorial programs	45
28	Using simulation programs	52
17	Using canned databases	39
16	Creating Databases	39

* Of all 294 Teachers Responding
\+ Of all 67 Teachers Responding

the proliferation of simulation games available on the market.

Evaluation Activities

Table 7 ranks expectations for using the microcomputer for specific evaluation activities. In 1985, expectations were fairly uniform across individual evaluation tasks. In 1992, expectations for use varied within the period considerably more than in the former period. In several cases, Table 7 shows a dramatic increase between 1985 and 1992 in the percentage of teachers who expected to use the microcomputer for evaluation activities. Four tasks: (1) getting student feedback, (2) evaluating which curriculum objectives can best be taught by using the microcomputer; (3) evaluating physical arrangements and scheduling; and, (4) evaluating the effects of microcomputer instruction all doubled or nearly doubled over the 1985-1992 period. Almost one half of the 1985 teachers expected to use the microcomputer to preview copies of software. From the earlier expectations preoccupation with previewing and purchasing software, teachers changed by 1992 to expecting to use microcomputers for getting student feedback, and evaluating which curriculum objectives are best taught. This trend shows the evolution and perhaps the maturation at both the school system and teacher levels as the use and possibilities for employing the microcomputer became more familiar to teachers, students and the school system and as the system and teachers redefined and refined, through the problem solving

TABLE 7

A COMPARISON OF TEACHERS EXPECTING TO USE COMPUTERS IN EVALUATION ACTIVITIES ACROSS TIME

% IN 1985*	TASKS	% IN 1992+
42	Previewing copies of software	54
38	Suggestions about software purchase	40
31	Getting student feedback	61
31	Locating sources of software review	43
30	Evaluating which curriculum obj. best taught	61
29	Eval. physical arrangements and scheduling	58
28	Eval. effects of your microcomputer instruction	52
25	Eval. Fairfax County program	40

* Of all 294 Teachers Responding
\+ Of all 67 Teachers Responding

process, the goals for the use of the microcomputer in instruction.

Summary of Teachers' Expectations

Thus, Tables 4-7 answer the second question of this study, "Was there any difference in teacher expectation of microcomputer usage across time? Was there any difference in expectation of microcomputer usage across time?" In 1985 and 1992 teachers expected to use microcomputers for the same tasks in Classroom Management and Instruction About Microcomputers, but different tasks in Instruction About Subject and Evaluation Activities. In almost all cases, expectations for use were higher in 1992 than in 1985, due to the availability of suitable software and the shift in direction of the school system from small, model units to overall system equal access use.

During the years between the two phases of this survey the teachers and the school system noticeably changed. Not only did the school system restructure the entire approach to microcomputer instructional use by 1992, but it also tailored inservice courses to match existing school conditions in order to foster more realistic expectations. In addition, more user friendly equipment and software was purchased. Teachers in the second sample were also more familiar with the microcomputer due to the rapid change in societys' attitudes towards microcomputer usage. A better understanding of just what to expect in implementing microcomputer usage in the

classroom became evident. Changes, both in the teachers and in the county by 1992, provided a very different basis for teacher expectations of microcomputer use in the classroom.

In the next section, the actual implementation of microcomputer use will be explored.

Implementation

In 1985, the change agents, teachers, were struggling with the implementation of microcomputers use in the classroom due to the lack of focused central direction from the school system. Teachers became the problem solvers in each specific situation, as the school system was also trying to find solutions. Besides introducing the parts and functions of the microcomputer to students, teachers, in this earlier period of time, emphasized creating individualized programs for use; the commercial market had not as yet produced many application software programs for the classroom and the school system was just beginning to address the issue of total system use as demanded by school administrators, teachers, and parents. By 1992, however, teachers were receiving appropriate inservice training and were often able to use commercial software in their classrooms.

Classroom Management

Table 8 again shows dramatic increases in the actual implementation of microcomputer use in the classroom. Implementation in Classroom Management, at the least, tripled from 1985 to 1992 with some tasks increasing as much as twelve times (2% to 24%). The school system enabled the teachers' use of microcomputers through hardware and software acquisition as well as through inservice training.

Teachers used microcomputers for the same Classroom Management tasks in 1985 as they did in 1992, but to a much greater extent in 1992. In 1992, between nine and thirty-nine percent of teachers used the microcomputer for individual tasks. In contrast, in 1985 only between 1 and 11% had used microcomputers for individual tasks performed in this area. This increase again was probably impacted by the amount of additional equipment and software available to teachers and the evolving goals of the school system for educating students and facilitating teacher implementation. Of particular interest is the task of reporting parent contact which increased twelve times from 2 to 24 percent by 1992. Due to increased emphasis placed by the school system for constant parent contact, (including IEP's (Individual Education Plan) for special education and reports concerning increased number and kinds of behavioral problems in schools), teachers found the computational and printing capabilities of the microcomputer an immense help in keeping track of the enormous volume of phone and personal conferences.

TABLE 8

A COMPARISON OF TEACHERS IMPLEMENTING CLASSROOM MANAGEMENT TASKS USING COMPUTERS ACROSS TIME

% IN 1985*	TASKS	% IN 1992+
11	Recording student grades	39
6	Averaging student grades	39
3	Keeping schedule of classroom activities	24
2	Reporting parent contact	24
2	Cataloging instructional materials	21
1	Recording disciplinary actions	10
1	Checking school supplies	9
1	Recording attendance	9

* Of all 294 Teachers Responding
\+ Of all 67 Teachers Responding

Instruction About Microcomputer

Table 9 again shows increased implementation between the 1985 sample and the 1992 sample. In 1985 twenty-one to twenty-five percent of the teachers implemented each of the top individual three tasks: (1) microcomputer vocabulary; (2) mechanics of programming; and, (3) write microcomputer programs. In 1992, thirty-nine to forty-five percent of the teachers implemented the top two tasks: (1) microcomputer vocabulary; and, (2) mechanics of programming. Of particular interest, however, is the reduction of interest by the 1992 sample in the task of writing microcomputer programs. In contrast to all other thirty-two tasks in this questionnaire, the 1992 percentage of implementation figure is lower than that of 1985. Teachers no longer wrote, but rather, bought off-the-shelf software. Thus in 1992, teachers were able to teach students about the use of different software, the selection of software, and microcomputer application in careers, as less time had to be spent in the creation of microcomputer programs.

Instruction About Subject

Table 10 shows a marked increase in implementation between 1985 and 1992. Between 12% and 17% of the teachers in 1985 implemented four individual tasks: (1) creating quizzes and tests; (2) using single purpose programs; 3) creating games; (4) creating drill and practice programs, whereas 31% to 78% of the 1992 teachers were

TABLE 9

A COMPARISON OF TEACHERS IMPLEMENTING INSTRUCTION ABOUT MICROCOMPUTER TASKS USING COMPUTERS ACROSS TIME

% IN 1985*	TASKS	% IN 1992+
25	Microcomputer vocabulary	45
23	Mechanics of programming	39
21	Write computer programs	18
15	Use of different software	46
14	Applications in careers	28
13	Teaching social impact of microcomputers	24
13	Teaching history of microcomputers	15
10	Selection of software	25

* Of all 294 Teachers Responding
+ Of all 67 Teachers Responding

TABLE 10

A COMPARISON OF TEACHERS IMPLEMENTING INSTRUCTION ABOUT SUBJECT USING COMPUTERS ACROSS TIME

% IN 1985*	TASKS	% IN 1992+
17	Creating quizzes and tests	78
13	Using single purpose programs	64
12	Creating games	52
12	Creating drill and practice programs	31
10	Using simulation programs	49
7	Creating tutorial programs	40
4	Creating databases	45
4	Using canned databases	36

* Of all 294 Teachers Responding
+ Of all 67 Teachers Responding

able to implement these same four tasks. Teachers, by 1992, were creating quizzes and tests. This basic subject specific microcomputer function was becoming commonplace by 1992. Two tasks, creating databases, and using canned databases increased around ten fold between 1985 and 1992, which highlights the advancement in classroom software and the ability of students and teachers to create sophisticated applications. This increased sophistication derives from several factors: (1) the change in school system policy direction; (2) the altered objectives and variety of teacher inservice courses; and, (3) the familiarity of both teachers and students with the microcomputer due to changes in society and the progress of the school system. Use in 1992 stands in stark contrast to use in 1985. In the former year the school system, teachers and students were all in a novitiative use.

Evaluation Activities

In Table 11, the percent of teachers using the microcomputer for the eight specified evaluation tasks ranged between 16% and 19% in 1985. By contrast, in 1992, the percent of teachers using the microcomputers for these same tasks ranged from 39% to 61%. Three evaluation tasks, (1)physical arrangement and scheduling, (2)curriculum objectives best taught using the microcomputer, and (3)getting student feedback on programs more than tripled between 1985 and 1992. Obvious reasons for this increase included the desire of the school system to ascertain that monetary

TABLE 11

A COMPARISON OF TEACHERS IMPLEMENTING TASKS IN EVALUATION ACTIVITIES USING COMPUTERS ACROSS TIME

% IN 1985*	TASKS	% IN 1992+
19	Previewing software	49
19	Suggestions about software purchases	39
18	Evaluation of physical arrangements and scheduling	58
18	Locating sources of software review	40
17	Evaluating which curriculum objectives best taught	61
17	Evaluating Fairfax County program	39
16	Getting student feedback on program	60
16	Evaluating effects of microcomputer instruction	42

* Of all 294 Teachers Responding
+ Of all 67 Teachers Responding

outlays were worth the investment and that their current policy direction was effective by requiring student and teacher feedback.

In 1985, the school system was still in its microcomputer infancy as were the creators of educational software. These conditions are reflected in the teachers' preoccupation with different aspects of newly emerging software. Teachers in 1985 used the microcomputer to preview software, to recommend purchases, and to locate sources. In 1992, teachers primarily used the microcomputer to evaluate curriculum, to elicit student feedback, and to arrange logistics. Regarding the use of microcomputers for evaluation related tasks, the chosen pyramid project teachers and math teachers were the only ones with access in the earlier period. By 1992, the situation had dramatically changed. Math and English teachers had free access; science teachers had limited access; social studies teachers, however, still had practically no access.

Summary of Teachers' Implementations

Thus, Tables 8-11 answer the third question of this study, "Was there any difference in implementation of microcomputer usage across time?" In almost all cases, teachers implemented more tasks in 1992 than in 1985, with startling increases in some numbers of tasks implemented. This helps to prove that as the county equipped the schools with hardware and software and appropriate inservice training

for staff, teachers took advantage of these opportunities and used the microcomputer for more tasks.

Further, in almost all cases, implementation per type of task was higher in 1992 than in 1985. During the years between the two phases of this survey, the teachers and the school system evolved. The school system regrouped from using small, well-planned implementation projects to inaugurating a full system program with a few model projects. The system was in the midst of this problem solving phase when teachers in 1985 were taking inservice courses. After a few years, when the focus turned to an overall approach, the system as a result of industry availability began to provide more software and equipment and refined teacher inservice courses which greatly increased use, with some different emphases on which tasks were implemented. In 1985 and 1992 teachers implemented the same individual tasks using microcomputers in Classroom Management, but different tasks in Instruction About Microcomputer, Instruction About Subject and Evaluation Activities.

Teachers using microcomputers also differed from 1985 to 1992. By 1992, for example, teachers were more familiar with microcomputers both privately and professionally; math and English teachers had full access to microcomputer use, with science teachers having limited access and social studies teachers only sporadic use; and teachers had a clearer idea of the focus and direction of the school system's objectives for microcomputer implementation.

The next section will explore the relationship between expectation and implementation.

Expectations in Relation to Implementation

Table 12 shows that the relationship between expectations and implementation changed between 1985 and 1992. Clearly teachers' expectations were closer to actual implementation in 1992. These relationships are seen in three of the four areas surveyed: Classroom Management; Instruction About Microcomputers; and, Evaluation Activities. Instruction about Microcomputers presents a different case. In 1985 few teachers were aware of the possible uses or county policies regarding microcomputers. By 1992, most teachers knew both.

For example, in 1985, teachers thought they would need to create software using the microcomputer to write computer programs, but few teachers actually completed this task. By 1992, teachers found that so much software was commercially available that there was no need to individually write programs. Teachers may also have learned that writing software was a very time consuming task and they could not fit this task into their schedules. In 1992, the system achieved such rapid progress in procurement of hardware and software that instruction about microcomputers became relatively less necessary.

Table 12, then, shows results to answer question 4, "After completing a county sponsored inservice microcomputer course, was there a difference between the expectations for and implementations of various tasks and types of tasks?"

TABLE 12

A COMPARISON OF EXPECTATIONS RELATED TO IMPLEMENTATION COMPUTER USE IN INDIVIDUAL TASKS ACROSS TIME

CLASSROOM MANAGEMENT TASKS				
% IN 1985*			% IN 1992+	
Expected	**Implement**		**Expected**	**Implement**
36	6	Averaging grades	42	39
34	11	Recording student grades	42	39
17	2	Cataloging instructional material	28	21
11	3	Keeping schedule of activities	28	24
10	2	Reporting parent contact	25	24
10	1	Recording attendance	24	9
9	1	Checking school supplies	13	9
6	1	Recording disciplinary actions	19	10
INSTRUCTION ABOUT MICROCOMPUTER TASKS				
31	25	Microcomputer vocabulary	49	45
31	23	Mechanics of programming	39	39
31	21	Write computer programs	38	18
25	15	Use of different software	52	46
20	14	Applications in careers	31	28
16	10	Selection of software	31	25
15	13	Teaching social impact of microcomputers	25	24
14	13	Teaching history of microcomputers	21	15
INSTRUCTION ABOUT SUBJECT AREA				
47	13	Using single purpose programs	75	64
41	17	Creating quizzes and tests	78	78
37	12	Creating drill and practice programs	42	31
31	12	Creating games	48	52
30	7	Creating tutorial programs	45	40
28	10	Using simulation programs	52	49
17	4	Using canned databases	39	36
16	4	Creating databases	39	45
EVALUATION ACTIVITIES				
42	19	Previewing copies of software	54	49
38	19	Suggestions about software purchase	40	39
31	16	Getting student feedback	61	60
31	18	Locating sources of software purchase	43	40
30	17	Eval. which curr. objectives best taught	61	61
29	18	Eval. phy. arrangements and scheduling	58	58
28	16	Eval. effects of your micro. instruction	52	42
25	17	Eval. Fairfax County program	40	39

* Of all 294 teachers responding

\+ Of all 67 teachers responding

As a rule of thumb differences are discussed only if there is a 10% difference.

Teachers' expectations for and their actual implementation of tasks using microcomputers differed from 1985 to 1992. Both the teachers and the school system profited from their seven year experience, each becoming more familiar with the microcomputer and the possible implementations for the optimum student benefit. In 1985, the school system's direction and objectives were unclear, which often led inservice instructors and teachers to expect more of the system than it was capable of delivering at that point. By 1992, school system officials and teachers were more aware of both the possibilities and realities of microcomputer implementation and of the best direction system policy should take given the many demands and the amount of support available. The percentage of teachers using microcomputers for individual tasks increased appreciably. In some cases, in using 10% as the average standard, usage increased as high as 20%, or 10% over the standard, between 1985 and 1992 due to the increased amount of equipment and software, individual and systemic experience with the microcomputer and also the new approach of both teachers and the school system in expectations and implementations. Therefore, in 1992, teachers used microcomputers because of the institutionalization of microcomputer systems and advances in the acquisition of hardware and software.

Obstacles

Major impediments or obstacles to microcomputer use can severely delay and even prevent effective implementation. Three obstacles most recently cited in the literature are: (1) insufficient microcomputer access; (2) insufficient software sources; and (3) inadequate staff development (Beaton, 1985; Miles, Saxl, and Lieberman, 1986). Both at the system level and at the teacher level, obstacles blocked implementation. At the school system level, different directions of emphasis, from the institution of a small, well-planned program to a full-scale system plan during the period of this study, resulted in confusion due to inappropriate teacher inservice training and the lack of microcomputers, commercial software and technical support. In this survey, teacher participants in the study were asked to list any obstacles that may have impeded actual implementation of microcomputer use. Participants were given blank lines on the survey form and asked to fill in any obstacles that they may have encountered when trying to implement their expectations of microcomputer use in the classroom. Respondents reported several obstacles at both the school and the system level that hampered implementation of tasks using the microcomputer. The obstacles divided easily into two groups: (1) physical; and (2) support. Physical obstacles included inadequate access to hardware, no hardware, software, money, and inadequate information regarding use. Support obstacles included lack of time, professional technical assistance, and training.

In Table 13, 1985 teachers reported the most obstacles occurring in using microcomputers for Classroom Management, followed by using microcomputers for Instruction About Subject area. When analyzing obstacles and strategies, the rule of thumb of 10% difference was again used. In 1985, 294 teachers reported 189 obstacles or 0.64 obstacles per teacher.

In 1992, teachers again encountered the most physical obstacles (Table 13) in Classroom Management. The 1992 teachers sampled encountered most support obstacles in Classroom Management, Instruction About Microcomputer, and Instruction About Subject. In 1992, 67 teachers reported 30 obstacles or 0.45 obstacles per teacher. Figure 3 shows the number of obstacles reported in graphic form.

The majority of teachers reported few or no obstacles in either year. This could mean that either no obstacles were encountered or that the teachers simply chose not report them. Teachers seemed to encounter a greater percentage of obstacles overall in 1985 than in 1992 in all areas except Instruction About Microcomputers. However, in 1992, teachers seemed to encounter more physical obstacles in the areas of Classroom Management and Instruction About Microcomputer and most support obstacles in the areas of Instruction About Subject and Evaluation Activities. Tables and additional explanation can be found in Appendix F.

TABLE 13

A COMPARISON OF OBSTACLES REPORTED BY AREA BY YEAR

1985						
TOTAL			OF THE TOTAL			
			PHYSICAL		SUPPORT	
AREAS	#	%	#	%	#	%
Classroom management	74	100%	55	74	19	26
Instruction about micro.	30	100%	21	70	9	30
Instruction about subject	59	100%	46	78	13	22
Evaluation activities	26	100%	16	62	10	38
Grand Total & Percentages	**189**		**138**	**73**	**51**	**27**
(.64 obstacles per teacher) 189 obstacles reported by 294 teachers						
1992						
Classroom management	10	100%	5	50	5	50
Instruction about micro.	7	100%	2	29	5	71
Instruction about subject	8	100%	3	38	5	63
Evaluation activities	5	100%	2	40	3	60
Grand Total & Percentages	**30**		**12**	**40**	**18**	**60**
(.45 obstacles per teacher) 30 obstacles listed by 67 teachers						

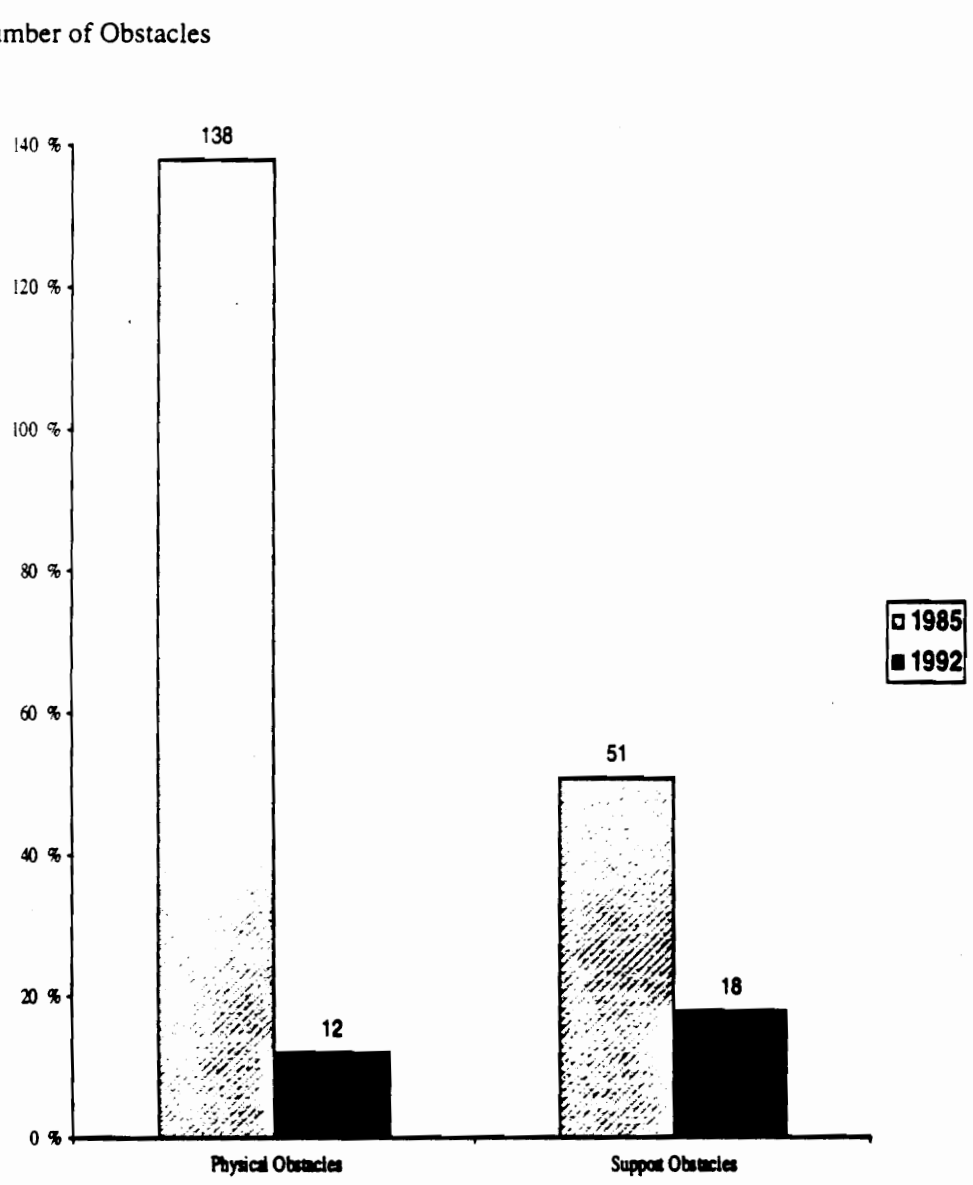


FIGURE 3.

NUMBER OF OBSTACLES REPORTED BY TEACHERS BY TYPE BY YEAR

Thus the above discussion answers the fifth question, "What obstacles did teachers find when trying to implement certain tasks such as management, instruction, and evaluation using the microcomputer?

Strategies

Strategies to overcome obstacles in implementing an innovation are essential if teacher change is to take place. These strategies must be on both building and system levels and could include meetings, demonstrations, on-going training, teacher participation in decision making, and generally assistance of all kinds. On the system level during the period between these two surveys, the school system used the strategy of expanding their microcomputer program to every school and encouraged assistance and support from every source, including PTAs, private corporations, and the general citizenry in order to acquire equipment and facilitate training. Teachers also created assorted strategies during the system's absence and confusion in order to implement microcomputer use in the classroom.

Participants in this study were asked to list on the survey form any strategies that they used to overcome obstacles that they faced in implementing tasks using the microcomputer in the classroom. While respondents reported several strategies that they employed while trying to implement classroom tasks, the numbers of strategies cited by teachers were rather limited. The strategies divided easily into two groups:

(1) school; and, (2) home. School strategies included teachers' staying after contract hours, microcomputers designated for teachers' personal use at school, money to purchase software, assistance from subject area departments or system offices, adaptation of workbooks and software, and arrangements for teachers to switch classrooms for microcomputer use. Home strategies included purchasing a microcomputer for home use, the creation of original software, and suggesting that students complete work on their own home microcomputers.

Table 14 shows the number and type of reported strategies reported on both the 1985 and 1992 surveys. In 1985, the most school strategies used were in Classroom Management, while home strategies were used in both areas of Classroom Management and Instruction About Subject. In 1985, the 294 teachers reported only a total of 81 strategies, or 0.28 strategies per teacher. In 1992, as noted in Table 14, of the school strategies used, slightly more were used in the area of instruction about subject, while slightly more home strategies were used in Classroom Management. In 1992, Table 14, the 67 teachers reported only 17 strategies, or 0.25 strategies per teacher. Figure 4 shows the number of strategies reported each year in graphic form.

Clearly, by 1992, a greater percentage (over the 10% average difference) of school related strategies were developed because the county had by then (1) purchased additional microcomputers and adequate software, and (2) instituted channels of communication about inservice.

TABLE 14

A COMPARISON OF STRATEGIES REPORTED BY AREA BY YEAR

1985						
TOTAL			OF THE TOTAL			
			SCHOOL		HOME	
AREAS	#	%	#	%	#	%
Classroom management	29	100%	14	48	15	52
Instruction about micro.	16	100%	10	63	6	37
Instruction about subject	26	100%	11	38	15	52
Evaluation activities	10	100%	7	70	3	30
Grand Total & Percentages	**81**		**42**	**52**	**39**	**48**
(.28 strategies per teacher) 81 strategies listed by 294 teachers						
1992						
Classroom management	6	100%	3	50	3	50
Instruction about micro.	2	100%	2	100	0	0
Instruction about subject	5	100%	4	80	1	20
Evaluation activities	4	100%	2	50	2	50
Grand Total & Percentages	**17**		**11**	**65**	**6**	**35**
(.25 strategies per teacher) 17 strategies listed by 67 teachers						

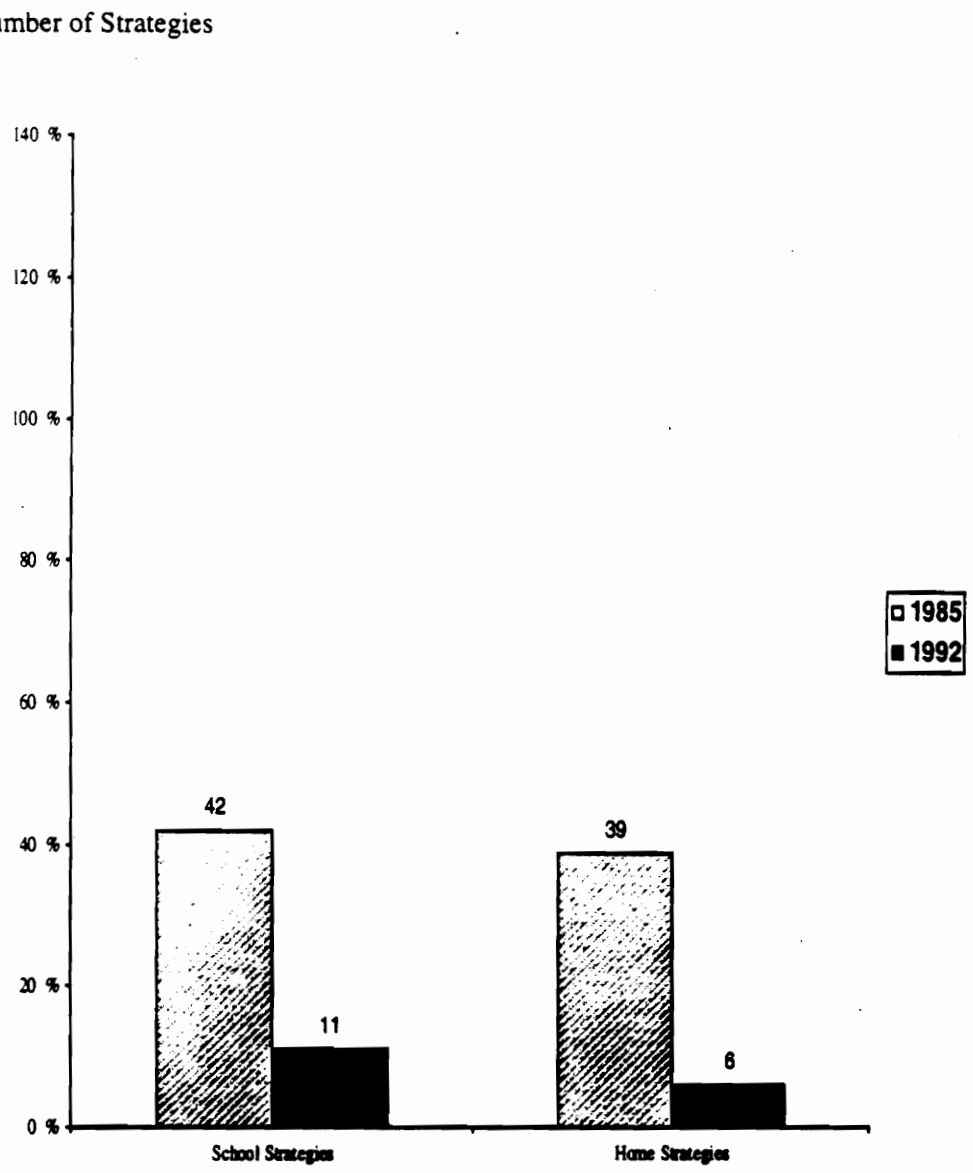


FIGURE 4.

NUMBER OF STRATEGIES TEACHERS REPROTED BY TYPE BY YEAR

Thus, question 6, "What problem solving about microcomputers occurred? Did teachers demonstrate strategies to overcome problems in implementing microcomputer tasks in the classroom?", has been addressed. For more information concerning strategies, tables and explanations are located in Appendix F. The next section explores the relationship between obstacles and implementation.

Obstacles and Implementation

In order to answer question 7, "What was the relationship between the obstacles encountered in both time periods and the amount of implementation?", obstacles in each area were first compared to implementation in each year and then compared to the total. Frequencies, descriptive statistics and crosstabs were used to compute the data.

Generally a higher percentage of teachers implemented tasks in the presence of obstacles in 1992 than in 1985. Only in the Area of Instruction About the Microcomputer did the 1985 teachers implement more than the teachers in 1992.

Thus, implementation occurred in spite of obstacles. In the area of Classroom Management, 1992 teachers implemented more than those in 1985, however in the Microcomputer Instruction About the Microcomputer area more tasks were accomplished in 1985. When teachers used the microcomputer for Instruction About Subject, the type of obstacle made a difference. In 1985, teachers who encountered

physical obstacles implemented more tasks than those in 1992. Lastly, the results were very close in both years concerning Evaluation Activities (Appendix G).

Strategies and Implementation

In order to answer question 8, "What was the relationship between the problem solving strategies used and the amount of implementation accomplished?" strategies in each area were compared to implementation in each year and then the total was compared. Frequencies, descriptive statistics, and crosstabs were used to compute the data.

Generally a greater fraction of teachers used strategies to implement tasks in 1992 than in 1985. School strategies were used by both the 1985 and 1992 teachers, with a greater percentage of school strategies used by the 1992 teachers (Appendix G).

Summary

This study examined the anticipated and executed microcomputer tasks by 361 participants who had taken a Fairfax County, Virginia Public Schools inservice course in microcomputer usage, in order to ascertain just what factors had an impact on teacher expected use and actual use of microcomputers in the classroom across and within a fixed time.

Differences were tested in relationships between expected and actual implementation of microcomputer use in the classroom as well as implementation related to obstacles and strategies across time (Appendix E, F, G).

CHAPTER 5

Overview, Conclusions, and Recommendations

Chapter 5 is divided into three major sections. The first section, Overview of Results, reviews the purpose of the research and the methods for achieving that purpose. The second section, Conclusions, begins with a discussion of the results of microcomputer implementation as affected by expectations, obstacles and strategies, and closes with the implications of the analyses and the comparison of the findings with other studies in the field. Finally, the third section, Recommendations, evaluates the practical applications of the results of the study, and describes the need for further development.

Overview of Results

School systems across the country have invested huge amounts of money, time, talent, and effort to establish integrated microcomputer learning programs for the benefit of the students, teachers, and the system. At both the system and classroom levels, administrators and teachers make decisions which affect the evolving use of the microcomputer. As a result, school systems are searching for, and need the assistance of, research in order to assess future directions adequately.

This study examined the microcomputer use by teachers who had taken an

inservice microcomputer course and the context in which that occurred. The research focused on teacher expectations for microcomputer use, actual implementation in the classroom, obstacles encountered and strategies used to overcome those obstacles and, the problem solving approach used by both the system and the teachers in accomplishing implementation in two different survey years. Data from the two survey years were complemented by interviews with officials familiar with various phases of the county's program.

All teachers who participated in the school system's inservice and who were surveyed in 1985, as well as those who attended the inservice courses and who were surveyed in 1992, were sent questionnaires to discover which tasks each had expected to implement and which tasks they ultimately implemented using microcomputers. The questionnaire listed thirty-two tasks divided into four areas: (1) Classroom Management; (2) Instruction About the Microcomputer; (3) Instruction About Subject; and, (4) Evaluation Activities. Teachers could also list the obstacles they encountered for each task, and strategies they used for each task to overcome these obstacles.

Changes Over Time

The characteristics of teachers who participated in the microcomputer inservice differed between the two survey years. The first major contrast between the survey years was teacher previous microcomputer experience, as few teachers in 1985 had

prior experience with microcomputers. By 1992, a majority of teachers had used microcomputers before enrolling in the inservice course. This prior use may have helped accelerate the teacher's integration and adaptation of microcomputers into the classroom and thus produced permanent change. Most teachers in the 1992 sample implemented microcomputer use in the classroom within three months of the completion of the inservice course. This contrasts with 1985, when the majority of teachers had rarely implemented microcomputer use upon completion of training due, in a large part, to the lack of equipment and commercial software.

The type of teacher who chose to enroll in the inservice course also differed across the years. In 1985, large proportions of teachers in the inservice course came from core subjects such as math and English, while in the 1992 sample year teachers' came from special group areas, such as special education, in addition to the core subject of math. Since microcomputer use in education was well underway by 1992, teachers in other than core subjects could gain access to microcomputers and training.

By contrast, the years of teaching experience and gender of teachers taking the inservice course remained relatively stable across the seven year interval, but by 1992, teachers taking inservice training were, on the average, older.

Overall expectations for microcomputer use, and implementation of that use, increased significantly over the time period measured. During the years between the two phases of this survey, the teachers and the school system changed. As problems in implementation arose, problem solving strategies were used by both the school

system and the teachers to resolve them. Not only did the school system redirect its goals and resources by regrouping to an over-all system approach with several model projects as opposed to a small, well-planned pyramid approach, but it also restructured its inservice program. In addition, the system increasingly provided the teachers with more user-friendly equipment, software and training. Teachers in the later year were more familiar with the microcomputer and had learned what to expect relative to implementation in the classroom. In contrast, the 1985 teachers had to employ many strategies, such as home use and expert assistance, to overcome equipment, software shortages, and lack of support.

As more microcomputers were acquired for the classroom, teachers expected to use the microcomputer for more tasks, and consequently they actually implemented more tasks using microcomputers. Over the time period studied, teachers reported fewer obstacles to using microcomputers in the classroom, such as insufficient microcomputer access, and useable software, and lack of time and professional technical assistance. Teachers also developed more and more strategies to overcome obstacles to microcomputer use. Teachers learned to use microcomputers at school after hours. In addition, they made arrangements to switch rooms for microcomputer use when the teachers had no microcomputers in their room.

Thus, several changes had taken place between 1985 and 1992 at both the school system and classroom levels, causing permanent change and providing a springboard for further evolution into future use of modern technology in the

classroom. These changes combined to form the basis for the following conclusions.

Findings

Eight questions were posed at the beginning of this study. This section directly addresses each of those questions in turn, and discusses the results of this study in the context of previous research.

Difference in Teacher Demographic Characteristics and Prior Microcomputer Experience

The first research question addresses the demographic characteristics of teachers who took an inservice course in both time periods. The question asked, "Who took general microcomputer literacy courses and how did teachers' responses differ in the two time periods? Goens and Clovis (1992) found that when trying to implement change, transformation connects the technical components with the human elements. By far the greatest and most fascinating change over time concerns the teacher's prior microcomputer experience characteristics. By 1992, the majority of teachers had experience with microcomputers prior to inservice training, a majority had microcomputers in their classrooms, and the majority of participants had experience with the microcomputers through workshops, courses, home use and school use (Mathison, 1992). Amazing strides had taken place by 1992 in teacher

prior microcomputer experience as opposed to members of the survey group in 1985 which had little previous microcomputer experience and entered the inservice course with only enthusiasm and dreams. Implementation by demographic characteristic is located in (Appendix D).

However, this positive approach of the 1985 group led to the attitude that anything was possible, and the problem solving method coupled with hard work pervaded the system. Those involved on each level, the system and the teacher, no matter what the obstacle, tried all sorts of strategies during each year, 1985 and 1992, to accomplish implementation of this innovation.

Expectations Over Time

The second question addressed the difference in teacher expectation of teacher microcomputers usage across time. The present study examined the survey years of 1985 and 1992 and resulted in findings that both support and extend previous research by showing that with adequate planning and support, expectations of innovational change at both the system and classroom levels is not only possible, but will also increase across time through the use of problem solving techniques, including well planned inservice training.

In each area of microcomputer use, Classroom Management, Instruction About Microcomputer, Instruction About Subject, and Evaluation Activities, expectation

increased from 1985 to 1992. In Instruction About Microcomputer and Evaluation Activities the number of tasks teachers expected to complete, while small, doubled. In the areas of Classroom Management and Instruction About Subject, the amount of tasks teachers expected to perform, although small, tripled. This finding was generally true for each area, with expectations concerning each task being different. By 1992, more equipment and software were available in county classrooms, so teachers expected to be able to accomplish tasks. As Brennan (1991) states, if the situation or environment created by the system for the teacher includes an adequate supply of equipment, everyone will experience an increased hope and involvement in integrating the microcomputer into classroom instruction.

Implementations Over Time

The third research question asked, "Was there any difference in teacher implementation of microcomputer usage across time?" It addresses the increase in time of teacher actual implementation of classroom tasks using the microcomputer. This study examined the survey years of 1985 and 1992 and resulted in findings that both support and extend previous research by demonstrating that with adequate planning and support, implementation of innovational change at both the system and classroom levels will increase across time with the use of problem solving strategies such as appropriate inservice training.

Conditions in the school system differed from 1985 to 1992. In the interim, the system experienced many stages in the process of implementing use of the microcomputer in the classroom.

These stages began with initial large mainframe microcomputers and progressed to the use of microcomputers for classroom task use. Pilot pyramid programs were developed and government grant money was used. Eventually the county supported a total microcomputer implementation plan for all schools. Inservice training was modified from courses in program writing to courses in specific microcomputer classroom task use.

A few microcomputer users instilled the vision for microcomputer use into the early inservice. But in these early years, many teachers became frustrated when their expectation could not be fulfilled. Problem solving, however, was being used in these early years by both the system and the teacher. When realities in the classroom hampered implementation, teachers tried home remedies and sought help from supervisors in their local school and in the system. The system also continued to search for funding as well as state-of-the-art equipment and software to solve the inadequate financial support provided by the community for implementation of microcomputer tasks systemwide.

As the years progressed and the problem solving approach continued, the system and teacher expertise and familiarity with microcomputers increased and along with it, expectations and implementations increased as well. Feedback and

communication about this new innovation was encountered, and everyone moved through different levels of use and concern. The process of the integration of microcomputers into the system became an illustration of the energizing of interactive partners in the educational change process (Hall, 1992). By 1992, expectations were more realistic and equipment became available, as the school system had implemented a system-wide approach with a few special model school sites. The teachers learned to use instructional technology more effectively and microcomputer operation was beginning to disseminate to individual classrooms from a total media center approach. Teacher inservice programs were addressing the use of microcomputers in a more realistic fashion, using every aspect of the change process, including practical application training. The Rand Study (Berman & McLaughlin, 1977), as well as a more recent study (Knupfer, 1986), also noted that poor preparation coupled with scarce equipment causes haphazard, uncoordinated, inequitable implementation of innovation.

In other words, attempted implementation in 1985 was not happening in a systematic way throughout the county. Inservice training was not geared toward application and microcomputers were scarce. Implementation of the innovation of the microcomputer by 1992 was taking place in a systematic way. Teachers were receiving appropriate inservice training and microcomputers plus software were available systemwide.

As Knupfer (1986) pointed out, conversely, successful implementation must be

planned thoroughly and flexibly, grounded in theoretical and practical dimensions of change. The changes in this study between the 1985 and 1992 survey years similarly illustrate the benefit of instilling planning and preparation in the process of innovation. Other departments besides math and English began to become involved with using microcomputers and the system level continued to refine and change policy and practice as microcomputer usage became more prevalent in our society.

Expectations and Implementations

The fourth question addresses expectations and implementations together. "In what ways did implementations differ from expectations?"

Research (Knupfer, 1986) indicates teachers approach microcomputer usage with a wide variety of expectations. When expectations are combined with support, significant change can affect the classroom practice of teachers (Brennan, 1991). Khamis (1992) notes that expectation of success reflects what individuals think they can do in a given situation including how hard they are willing to try. The present study revealed that expectations indeed exceeded implementation in both years, but the differences varied by task area and by year.

Most task areas showed significant differences between expectations and implementation. In 1992, the mean differences between expectations and implementation were smaller than they had been in 1985. By the later year, the

County used a more realistic approach in the inservice courses taught and the teachers also knew independently what tasks could and could not be facilitated by the microcomputer. Previous research (Khamis, 1987) pointed to a lack of inner confidence as one cause of the difference between expectation and implementation. This does not seem to pertain to this study. Teachers in this school system were not only interested and challenged, but also had no reservations about their abilities. They simply had too few microcomputers to use and fewer programs to apply readily to classroom activities.

Only two task areas, those of Instruction About the Microcomputer in 1985 and Evaluation Activities in 1992, showed no sizeable differences between expectations and implementations. Knowledge concerning the microcomputer was uncommon in 1985 so teachers implemented more instructional tasks about the microcomputer than they expected in this category. Similarly in 1992 the system required more evaluation in the Program of Studies in all subject areas including the use of the microcomputer in the classroom, so expectation of using evaluation tasks was more closely aligned with implementations during this time period.

In previous studies, expectations and implementations were assumed to be dependent upon structural change which can be altered administratively including school microcomputer coordinators (Reinhold, 1985), and behavioral changes which require the learning of new roles (Goens & Clovis, 1992). Both of these cases were illustrated in this study. As the school system systematically increased hardware and

software in the system and the inservice course training became more aligned with available equipment and software, structural change occurred. Similarly, behavioral changes happened as teachers' expectations concerning the implementation of microcomputers became more realistic and their roles changed to facilitators of actual microcomputer usage in the classroom.

Thus, through the problem solving process, the system and the teacher narrowed the gap between expectation and implementation by 1992. Each level analyzed the obstacles to implementation in 1985, such as inadequate microcomputer implementation goal setting in inservice training and lack of equipment and software, and found strategies to overcome implementation hindrances. These strategies included inservice training that more closely coincided with the realities in the classroom and the acquisition of more equipment and suitable software.

Obstacles

The fifth research question asked, "What obstacles did teachers face?" Obstacles in this study, as suggested in previous research included, lack of equipment, lack of budgetary and expert support (Strudler & Gall, 1988), and inadequate inservice training with a standard for programs to meet teacher need (Mathison, 1992). These easily divided into two broad types: physical and support. Interestingly, a higher percentage of obstacles per teacher were reported in 1992, and

the number of each type of obstacle differed across years (Figure 3). In 1992, 40% were physical and 60% were due to lack of support. This finding reflects two facts (1) Fairfax County, by 1992, had purchased much more equipment and (2) appropriate commercial software was more available than in previous years. The increase in lack of support in 1992 is thus attributed to the fact that more physical needs were met, so more support was needed. Also teachers now recognized a greater need for support than in 1985, as their concerns about machinery and software acquisition were satisfied. Thus, by 1992, teachers felt deeply the lack of support in the form of system expert assistance, site training, and additional time in daily schedule for microcomputer implementation. Ironically, at the same time, budget constraints forced staff reduction in microcomputer lab aides and central microcomputer instructional staff. The system also was forced to provide fewer outside expert training sessions for administrators and teachers. As Apple (1992) states, education has increasingly become dominated by economic concerns that lead to educational crisis. Therefore the lack of manpower, constraints on time of existing staff, and the decrease of available training by experts all contributed to the lack of support.

Strategies

The sixth research question examined the types of strategies and problem

solving techniques teachers used. The question asked, "What strategies and problem solving techniques did teachers employ?" Berman and McLaughlin (1977) noted that strategies to overcome obstacles were necessary to implement an innovation.

Strategies fell into two groups, school and home. The fascinating aspect of these findings is that many more teachers reported strategies in 1992. In 1985, the teachers used the home strategies of buying their own microcomputers, or asking the students to finish or attempt microcomputer tasks at home or in school through some arrangement of lab sharing with the math department. Teachers often stayed after school hours to accomplish tasks using the math lab microcomputers. However, with increased equipment and software available in 1992, more strategies could be employed in general, and most were employed at school with less stress on the teacher to find a solution at home.

Obstacles and Implementation

The seventh question addresses obstacles as related to implementation. The question asks, "How were obstacles related to implementation?"

Interestingly enough the degree of actual implementation was not related to the number of obstacles. However, there was a greater percentage of obstacles proportionately reported in 1985 than in 1992. Generally more 1992 teachers implemented tasks in the presence of obstacles than the teachers in the 1985 sample.

Only in the area of Instruction About Microcomputer did 1985 teachers implement almost the same as the 1992 teachers.

In 1985, the lack of equipment was a main obstacle for teachers. By 1992, this became less of a problem. In the later year, the obstacles were caused mainly by the lack of support from county staff and school personnel. Perhaps teachers noticed the need of support after their physical needs were met. Obstacles, then were an important part of the attempt to implement.

Strategies and Implementation

Only in Classroom Management did the use of strategies make a difference in the accomplishment of microcomputer implementation in the classroom. In other areas, no relationship was found between strategies and implementation. In each survey year, conditions were different, with equipment lacking in 1985 and instructional support needed in 1992. However, in each case strategies were created by the system and by the teachers through problem solving. In this study, the Classroom Management area related to strategies and implementation. In 1985, teachers implemented strategies in order to complete classroom management tasks, such as averaging grades and keeping track of materials. By 1992, the system employed the strategy of procuring equipment and software to assist implementation in school.

Conclusions

In both years, expectations were greater than implementation. In the later year, when appropriate inservice training and adequate equipment and materials were in place, there was at that time less difference between expectation and implementation. There were also differences in the two years in the type of obstacles in strategies that were used. Implementation is likely to be closest to expectations if the court systems are in place. Problem solving was observed on both the system and teacher levels.

Recommendations

The purpose of this study was to ascertain whether teachers, after completing an inservice course about microcomputers, were able to implement expected tasks in the classroom during two different survey years. The results of this research suggests both implications for current practice and directions for future research.

Implications for Current Practice

1. When trying to effect change using innovations such as the microcomputer in the classroom, inservice courses should parallel reality. Otherwise, expectations far outstrip the actual possible classroom implementations. In 1985, microcomputer

coursework did not apply to use in the classroom. When I took the original microcomputed course I was only taught how to write programs, not how to use the microcomputer in the classroom. Upon my return to Fairfax County in 1990, courses were tailored to classroom use. This was a change of curriculum from 1985. My experience is reflected in the data of this study which showed that there was less of a gap between expectation and implementation.

2. Technical training and support should also be readily available for teachers at every stage of the implementation phase, either by providing a school based expert or a very accessible school system expert, so that teachers do not become discouraged as they face obstacles in their attempts to implement change. During 1985, there were no school based experts to help teachers after they completed the course. Teachers had to struggle on their own to facilitate microcomputer use. Upon my return to Fairfax County in 1990, every school had microcomputer labs with experts. The county also had expert teams who advised teachers. Originally problems most often represented lack of physical equipment. As that problem was solved, people became more aware of the need for support. Although there was more physical support, they reported more need of support assistance.

3. Microcomputer access is a continuing problem and one very different in each survey year, 1985 and 1992. In 1985, few microcomputers and suitable software were available to teachers for usage. However, although more equipment and software became available in 1992, access still remained a problem for the entire

faculty of teachers as more teachers desired access. Some subject areas still had no or only limited access. Thus, this problem still must be addressed.

4. Because the type of obstacle differs at different stages of implementation, the type of strategy that is useful at different stages also differs. The system must assist in providing strategies.

Implications for Further Research

1. More long term studies regarding microcomputers need to be conducted, because much can be learned about change and expectation becoming a reality in implementation over time. Studies can show the many aspects of the problem solving process, the forward and backward steps in the course of implementation of microcomputer use. Very few studies exist especially in this new field of the microcomputer. School systems and teachers who plan to attempt implementing change can greatly benefit from such longitudinal studies.

2. As regards the research on the implementation of the microcomputer in the classroom through the school system, additional study should be undertaken to investigate specific kinds of support needed to create change over time.

3. Where possible, it would also be desirable to study change on both the individual and system levels. This enables an entire view of most of the aspects involved in the change process and discovers whether the system is changing as

individuals change and if the system is listening to the individuals involved.

Thus, the institution of education, which has been called upon once again to change in order to mirror changes in society, not only appears to have survived the challenge, but has succeeded and even thrived in creating problem solving approaches and strategies in order to accomplish, in this case, the implementation of the innovation. School systems, as well as classroom teachers approach implementation with a variety of expectations. Through training and an evolving problem solving process, which address all possible ideas, obstacles and strategies, excitement and vision can be maintained. During the process, new program directions can also be faced and incorporated into the plan so that everyone benefits and, at the same time, new national directions can be accommodated. Many schools are still working through the early phases of microcomputer usage implementation that the FCPS was undergoing in 1985. This study may prove to be helpful to other schools as they attempt the implementation of the microcomputer for classroom tasks.

APPENDIX A

Context of Study

Context of Study

This study focused on the microcomputer program in the Fairfax County, Virginia, Public School (FCPS) system (Fairfax County Public Schools, 1984) located in the northern Virginia section of the greater metropolitan area of Washington, D.C.

Prior to using the computer for instruction, Fairfax County pioneered mainframe use in the school system administrative/business departments in 1967. The county chose the IBM140 not only to perform school system administrative tasks, but also to interface with the computer system of the Fairfax County government. This huge investment resulted in the county use of cards to facilitate the master schedule in schools into the early 1980's. Between 1976-1980, as the school system began to address the possibility of computer use in instructional applications, it chose the HP3000 which was purported to have the dual capability of administrative and instructional faculties. Also, at this time, a few math and science teachers and instructional administrators wanted to initiate microcomputers into the school system for classroom use. The system did not provide for training for the instructional use of the HP3000. As the system and teachers tried to use the HP3000 for instructional use, each realized that the HP3000 did not have the instructional capabilities that had been originally anticipated. The system sought advice from IBM, as the county had experienced good results previously from IBM contracts, even though IBM had yet to create a personal computer. Since Ataris had a closed unit, easy for student use, as

opposed to Apple, Alari were recommended and became the first machine widely used in Fairfax. In addition, Atari had already created some instructional software. Soon, the Apple Company began to redesign their hardware and to create instructional software. At this point, the County switched to using Apples. The instructional technology department was also created and asked to design an instructional program, as most system level administrators knew little about the possibilities of using the microcomputer for classroom instruction.

In order to facilitate classroom instruction, administrators had to decide between having one mainframe with classroom links or individual microcomputers in classrooms. Both ways were eventually used in specific schools. Between 1980-1984, elementary schools were chosen in certain areas of the system to begin the microcomputer instructional program. In these pilot programs, equipment was provided and on-site training was conducted. The microcomputer was used as an extension for the science laboratory equipment, as a managerial tool in applied economics, as a writing tool in English classes, as a problem solving tool in K-8 mathematics, and as a learning aid in special education. Besides these pilot projects, a five year technology plan was also implemented. The vocational department, meanwhile, decided to go with IBM, as that was the machine that most businesses were using.

By 1982 a committee of parents, community leaders, and county administrators was formed. This group wanted the Fairfax County Schools

computerized and went directly to the Board of Supervisors, instead of working through instruction, subsequently becoming the spearhead for the reality. This group procured money from the private sector and created the microcomputer lab at Langley High School as their first project. This lab was linked through their business education department, thus linking students with jobs through the use of microcomputers. At this point the instructional technology department's progress accelerated. Its headquarters, Chapel Square, became a lab linked with satellites, including a TV studio, teleconference facilities, and microcomputer labs (IBM originally asked to donate start-up, declined, so free Apple microcomputers were installed). IBM decided later to also join in the effort and labs were developed using both sets of hardware. Besides the instructional technology headquarters, one other unique microcomputer center was created, an advanced math and science high school. This school, Thomas Jefferson (TJ), was originally planned to be a vocational school. The business community stated that if TJ were transformed into a state of the art high tech school, then money could be obtained for sponsorship. Thus, TJ became the first school to have an instructional computer mainframe (Hewlitt Packard) with access to the supercomputers of major universities, such as Carnegie Melon and Cornell. In addition, students from TJ entered into a national competition and won an E10 supercomputer as first prize. TJ is filled with microcomputer labs containing Apples and IBMs which are all linked to the mainframe. Dedicated lines also connect, through modems, teachers and students. TJ is now linked with the

Southwest Virginia Coalition of Schools (15 school systems) through George Mason and Virginia Polytechnic Universities using modem connections. Plans to expand to the use of fiber optic connections are currently being reviewed and developed. Using this Governors School example, Vice-President Gore is currently stressing that the entire United States should proceed to accomplish a similar total network which would eventually link with other countries to create a "global village."

Thus, Fairfax County developed instructional computing originally from a business perspective which led in many directions. Even so, the program development in FCPS was based on the belief that the instructional uses of the computer should be integrated into the FCPS Program of Studies (POS), which is a curriculum objective plan for all grade levels in the county. FCPS's microcomputer literacy program was developed as part of a five year plan for instructional technology to be introduced into all schools according to a realistic planned schedule for teacher training and acquisition of equipment. Modifications to the original plan were due to the decline of prices for microcomputer software and community support. Additional guidance was given to FCPS by Cresap, McCormick, and Paget Incorporation consultants, who developed a comprehensive plan and by the Technology Task Force of the Curriculum Council of FCPS which is made up of teachers and supervisors of the county. In 1984, because of unexpected Federal government funding through Project LITT, Learning Improvement Through Technology, it was also possible to begin exploratory activities in using the computer as a tool to support instructional

objectives beyond the microcomputer literacy level.

Between 1984-1986, FCPS instructional technology program components included curriculum development, teacher training, equipment and software. The focus consisted of computer applications in most disciplines and use of the computer as a problem solving tool on all grade levels.

By the middle of the school year 1983-84, teacher training was revised to include computer applications across disciplines. In 1984, 1,760 secondary teachers both intermediate and high school and 1,290 elementary teachers were trained through inservice courses (non-college credit and college credit courses, and conferences). During fiscal year 1985, FCPS expanded these applications to more sites because of Project LITT (Learning Improvement Through Technology); the IBM Project; and the Superintendent's Mini-Grant Program. FCPS also developed a curriculum framework for implementation of computer literacy and computer science/business data processing.

In the teacher training area, the challenge was for the teacher to become computer literate, competent in operating the machines, proficient in teaching computer literacy to students, proficient in reviewing and evaluating educational software, comfortable with using various software packages such as word processing, simulations and tutorials, and knowledgeable of the many instructional applications of the computer. By fiscal year 1986, all elementary staff involved in computer literacy had the opportunity for training and secondary teachers were given additional training

in computer applications. Equipment was acquired with appropriated funds related to school project program implementation. Software was initially purchased to introduce students and teachers to various capabilities of the microcomputer, and to become familiar with the keyboard. No attempt was made to standardize selections. Systemwide guidelines for evaluation, selection, and purchase of software existed by 1985.

In the program status area, computer literacy was divided into three parts: elementary, intermediate, and secondary. On the elementary level, computer literacy was integrated into the POS (Program of Studies). Field testing of curriculum occurred in pilot schools and three year implementation in all schools was underway by 1984. In the fall of 1982, three non-college credit courses were offered to teachers from a particular school. These teachers were the teachers in a turn around training model. However, this model lacked consistency and was not considered effective. A substitute plan was then developed which identified a computer team and liaison staff member at each elementary school. A standardized teacher training model was developed which included a formal evaluation of the course with an attitude survey and a content test. By June 30, 1984, all elementary schools had one microcomputer to be used for the first phase of teacher training. After completion of training, additional equipment was allocated to the school consisting of the ratio of one microcomputer per every 200 students in grades K-4 and one microcomputer for every 60 students in grades 5-6.

On the intermediate level, grades 7 and 8, the computer literacy program was integrated into the major disciplines. Mathematics courses had materials already developed based on no prerequisite skills with focus on problem-solving, critical thinking, and the computer application. The social studies discipline was the next subject area planned for focus of the microcomputer. At this level there was one microcomputer per every 150 students.

At the high school level, computer literacy began on the ninth grade level with an emphasis on problem solving. After computer literacy was implemented in the K-8 grades, the ninth grade microcomputer literacy was phased out during the 1985-86 school year, except for new students. The focus for the high school was then on the use of the computer as an instructional tool for students and teachers. The microcomputers assisted learning, managed instruction, fostered problem solving, and encouraged creative thinking.

Areas for microcomputer usage in the FCPS included the following: (1) computer managed instruction which assisted teachers and principals in the management of K-6 material such as keeping track of student achievement and instructional objectives; (2) the CAI, computer assisted instruction, used exploratory activities and development and use through the mini-grant program; (3) Project LITT, Learning Improvement Through Technology, which began in August, 1983, through the Office of Instructional Technology with a federal grant of $133,600.00, supported the improvement of basic skills using technology, assisted improved problem-solving

skills and writing skills using the word processor, and used technology in the secondary classroom. In the spring of 1984, a professional development center was established for training instructional in staff in computer applications known as the IBM Project in which FCPS was selected as 1 of 28 school districts nationwide to receive a grant from IBM. This consisted of 90 microcomputers and supplies for 5 schools and the professional development center to advance the efforts of computer literacy and to begin applying the microcomputer as an instructional tool. Schools had to be eligible for federal compensatory educational funding to be selected. Two Office of Instructional Technology staff members were trained by IBM and the Bank Street College as leaders in instructional use of the computers. By 1986 (Fairfax County Public Schools, 1986), Project LITT, CMI, IBM, and the Superintendent's Mini-Grants were implemented and evaluated.

During the fiscal years of 1986-1990, a new comprehensive five year plan for instructional technology was developed which included expanded use of the professional development center. Also through work with the curriculum committee, the establishment of an internal maintenance capability was studied. More importantly, during the years of 1986 through 1992, the school system moved away from computer literacy to computer application. Students were not learning about computer languages anymore, but about keyboarding and computer application in grades 7-12.

Between 1987-89, FCPS received a federal grant which provided for specific

applications and put microcomputers in English departments for word processing. Science departments experienced a subtle POS (Program of Studies) curriculum revision with the "Voyage of the Mimi" simulation TV show for the seventh grade. In the middle school math departments, BASIC was used to solve everyday problems through "CAPS", Computer Application Problems Solving. Thus, the emphasis was on problem solving instead of programming. These programs were systematically implemented in several schools throughout the system. Meanwhile, middle school science moved toward the Micro-Based Laboratories (MBL) in which a recording instrument (the probe) was attached to the microcomputer to use in experiment analysis. The high school program had no major thrust. Different subjects explored various appropriate software, however, math did explore the Turbo Pascal in computer science.

During the 1990-1991 school year, the first major curriculum revision that required microcomputer technology occurred in the school system for the Algebra I Program of Studies. This program, the IBM Network Lab, dealt with the mathematics tool kit of math modeling with three dimensional figures. The Lab was used two to three times per week in high school Algebra I and eventually in Geometry.

By fiscal year 1992 (Fairfax County Public Schools, 1992), emphasis continued to be placed on curriculum revision, teacher training, and equipment/software acquisition even though budget constraints forced a cutback in

school and area based microcomputer personnel.

In 1992, Virginia gave middle schools MAC LC's for support of the Literacy Passport State Test. Math and reading teachers were taught how to use the microcomputers and software over a four day period using three leaders from every school. Each intermediate school received eight machines and two printers. At the same time the school system replaced all of the old Ataris at the middle School level with MAC LCs. The "Geometry Sketch Pad" and the "Statistic Workshop" programs were used in the math classrooms. These programs stressed the same kinds of applications of problem solving, predicting, and data analysis, but with better tools, ie. microcomputer language.

By 1993, as more intermediate schools (grades 7 & 8) became middle schools (grades 6,7, & 8), the school system goal was to assign 40 microcomputers to each school academic team (4 core subject teachers of 130 students) rather than by departments. Ten of the microcomputers were specifically assigned to science because of the probeware program use as an open-ended tool. Internal fighting between schools occurred as, in some cases, more Ataris were taken from schools with fewer MAC replacements. The school system continued to try to break down the barriers in each school of who had the microcomputers and where they should be.

In the major subject areas the goals all stayed the same, but the tools had changed. In English, the major emphasis was still on word processing, in math on problem solving, and in science the probeware program. Social studies still had no

support from the school system social studies department with no funding and no push to become microcomputerized. In the future, the team approach may help the social studies areas in each middle school. In two intermediate schools, the school system established integrated learning systems. Initially, these systems were used for remediation, although GT (gifted and talented) students could have been accommodated as well. This remedial program, networked with major company software, used a select group of students who were managed and tracked.

Future fiscal year budgets and goals for the microcomputer program are still being formulated as many groups within the school system and county have still to submit input. Some suggested three to five year goals for the intermediate level per school which would include: one 30-station lab per grade level for word processing applications; one 15-station lab per grade level for spreadsheet applications; one 10-station lab per grade level for probeware applications; 4 workstations per grade level for data base applications; 6 workstations for microcomputer-aided design and manufacturing applications; 6 workstations for desktop publishing; a library networked with INLEX; one workstation with CD-ROM player for information retrieval applications; one workstation per core subject classroom; four multimedia workstations per grade level; and, one workstation per related arts program (FL, HPE, ESL, Art, Music, Tech Ed, and Home Economics). By FY 1994, it was recommended by instructional technology staffs that resources be provided to initiate a three to five year plan by enhancing the use of existing microcomputer resources,

expanding resources available to all students, and examining effective ways to utilize resources allocated to pilot programs.

For high school, the instructional technology staff pointed out that inadequate amounts of technology equipment is a major problem due to insufficient funds. Therefore, the school system must choose from equally deserving instructional goals. The staff also stated that as technology-related objectives become a part of the Program of Studies and technology-related curriculum is developed, teachers must be trained and the technology must be available in the schools. Some three to five year goal suggestions include: a multimedia workstation (microcomputer, laserdisc, CD-ROM and a library media resource connection) available (per school 28 to 48) to each teacher for presentation and to every student for research and presentation; for science CD-ROMs, videodiscs, second generation probeware and software, interactive problem solving software, simulations of concepts that are difficult to teach otherwise, on-line data base searching capabilities for all science areas, and 3 to 4 science/microcomputer labs with the prescribed information technologies for each science department; student access to technology for word processing and information research at least two periods per week facilitated by additional school-based writing labs; multi use (social studies/foreign language) cooperative learning lab with 8 to 10 student workstations and a teacher station per school; fine arts and vocational education students frequent and regular access to systems with additional input and output devices; 10 systems for every school library to facilitate all of the school's

microcomputers access to the library and its information systems.

Thus, in light of the above discussion in the review of the literature, Fairfax County, after analyzing its own staff, students, community, and general environment, with well-grounded knowledge of change and innovation literature and inservice practices, embarked upon the task of making the Fairfax County Public Schools microcomputer literate and cognizant of microcomputer applications. The administrative staff of the county also kept informed of outside assistance in order to enhance their already comprehensive program. In the case of Fairfax, the administrators and the community decided that computer literacy and applications were desired goals for the system. At this point, a few individuals from the system were then chosen to "spear-head" this innovation adoption. It is most important that the change agent know the informal leaders. With such people working on your side, you will have a good chance of influencing the entire client system. Beaton (1985) concurs, that change agents and those they choose are vital to the process and as Matheson (1992) points out, this enhances the teacher need for professional experiences. So the early adopter and early majority people who were both influential and change-oriented were identified in order to be given first priority to receive training in the innovation of the microcomputer. In line with this thinking and in light of the sparse monies available in the beginning, training members of the Fairfax staff seemed to be the more logical and cost effective alternative. As stated above, inservice for the entire system was underway. Therefore, Fairfax County initially

proceeded very carefully and methodically in the light of administrative decision making and changed over time in reaction to community demands, budget decreases, and advances in technology.

APPENDIX B

Questionnaire

Appendix B-1

QUESTIONNAIRE

Please circle the alphabetic character that corresponds to the most appropriate answer or answers.

1. Primary subject teaching responsibility

   A. Mathematics
   B. Science
   C. English
   D. Social Studies/History
   E. Foreign Language
   F. Business
   G. Special Education
   H. Music
   I. Art
   J. Other; Please list:
   _____
   _____

2. Years of teaching experience

   A. Less than 3 years
   B. 3-7 years
   C. 8-10 years
   D. 11-20 years
   E. Over 20 years

3. Gender

   A. Female
   B. Male

4. Age

   A. 20-29 years
   B. 30-39 years
   C. 40-49 years
   D. 50-59 years
   E. 60-69 years

5. Previous experience with computers (micros, otherwise, etc.)

Experience	None	Little	Some	Much
A. Workshops				
B. Course(s)				
C. Computer Ownership				
D. Work Use				
E. School Use				
F. Other; Please describe: _____				

6. When did you take the FCPS initial microcomputer course?

   School Year

   A. 1980-81
   B. 1981-82
   C. 1982-83
   G. 1983-84
   H. Other

7. Was the type of machine you used in the course the same or very similar to the one you used in the classroom?

   A. Yes
   B. No
   C. Does not apply

8. Prior to this course were you making any use(s) of the microcomputer?

   A. Classroom Management
   B. Instruction About Microcomputer
   C. Instruction About Your Subject
   D. Evaluation Activities Related to Microcomputer Usage
   E. No use
   F. Does not apply

9. Was the language you used in the course the same or very similar to the one you used in your classroom?

   A. Yes
   B. No
   C. Does not apply

10. Reasons for taking the FCPS sponsored initial microcomputer course?

    A. Voluntary
    B. Involuntary
    C. Required to implement program
    D. Recertification

11. If voluntary, reasons for taking the course?

    A. Curiosity
    B. Familiarity
    C. Hoping to implement in the classroom
    D. Dedicated to microcomputer use in the schools
    E. Other; Please describe: _____
    _____

12. How much time elapsed between the date of your course completion and the start of your microcomputer implementation?

    A. Less than 3 months
    B. 3-6 months
    C. 7-9 months
    D. 10-12 months
    E. Over 12 months
    F. Did not implement

After taking the Fairfax County Public School course, which of these things did you expect to do and what did you actually do? Did you encounter any obstacles (lack of support, shortage of materials, negative school atmosphere, etc.) when trying to do any of these things with microcomputers in your classroom? What strategies did you use to overcome them? Please circle yes or no and comment where appropriate.

A. CLASSROOM MANAGEMENT BY USE OF THE MICROCOMPUTER

	DID YOU EXPECT TO USE THE MICRO-COMPUTER TO DO THIS TASK?		ARE YOU NOW DOING THIS TASK USING THE MICROCOMPUTER?		WHAT OBSTACLES HAVE YOU FOUND TO DOING THIS TASK?	WHAT STRATEGIES HAVE YOU IMPLEMENTED TO TRY TO OVERCOME THESE OBSTACLES?
			Y	N		
1. recording attendance	Y	N			1.	
2. recording student grades	Y	N	Y	N	2.	
3. averaging student grades	Y	N	Y	N	3.	
4. checking books/ materials/supplies for the year	Y	N	Y	N	4.	
5. reporting parent contact information for the year	Y	N	Y	N	5.	
6. recording disciplinary actions	Y	N	Y	N	6.	
7. keeping schedule of classroom activities	Y	N			7.	
8. cataloging instructional materials	Y	N			8	

COMMENTS: _____

Please circle yes or no and comment where appropriate.

B. INSTRUCTION ABOUT MICROCOMPUTER

	DID YOU EXPECT TO USE THE MICRO-COMPUTER TO DO THIS TASK?		ARE YOU NOW DOING THIS TASK USING THE MICROCOMPUTER?		WHAT OBSTACLES HAVE YOU FOUND TO DOING THIS TASK?	WHAT STRATEGIES HAVE YOU IMPLEMENTED TO TRY TO OVERCOME THESE OBSTACLES?
1. teaching history of microcomputers	Y	N	Y	N	1.	
2. teaching social impact of micro-computers (daily life)	Y	N	Y	N	2.	
3. teaching about microcomputer applications (careers)	Y	N	Y	N	3.	
4. teaching about the mechanics ofmicrocomputer programming(commands, functions, graphics)	Y	N	Y	N	4.	
5. teaching microcomputer vocabulary(diskette, printer; boot, loop, debug, etc.)	Y	N	Y	N	5.	
6. teaching about the use of different types of software	Y	N	Y	N	6.	
7. teaching about selection of software	Y	N	Y	N	7.	
8. teaching students to write computer programs (machines plus subject matter content)	Y	N	Y	N	8	

COMMENT: _____

Appendix B-4

Please circle yes or no and comment where appropriate.

C. INSTRUCTION ABOUT YOUR SUBJECT AREA

	DID YOU EXPECT TO USE THE MICRO-COMPUTER TO DO THIS TASK?		ARE YOU NOW DOING THIS TASK USING THE MICROCOMPUTER?		WHAT OBSTACLES HAVE YOU FOUND TO DOING THIS TASK?	WHAT STRATEGIES HAVE YOU IMPLEMENTED TO TRY TO OVERCOME THESE OBSTACLES?
1. using single purpose programs (drill & practice, tutorial)	Y	N	Y	N	1.	
2. using simulation programs (programs designed for more complex modes of interaction)	Y	N	Y	N	2.	
3. using canned databases	Y	N	Y	N	3.	
4. creating cross-word puzzles and other games	Y	N	Y	N	4.	
5. creating quizzes and test	Y	N	Y	N	5.	
6. creating data bases and references	Y	N	Y	N	6.	
7. creating drill & practice programs	Y	N	Y	N	7.	
8. creating tutorial programs	Y	N	Y	N	8.	

COMMENT: _____

D. EVALUATE ACTIVITIES RELATED TO MICROCOMPUTER USAGE

	DID YOU EXPECT TO USE KNOWLEDGE FROM THE MICRO-COMPUTER COURSE TO DO THIS TASK?		ARE YOU NOW DOING THIS TASK USING KNOWLEDGE FROM THE MICRO-COMPUTER COURSE?		WHAT OBSTACLES HAVE YOU FOUND TO DOING THIS TASK?	WHAT STRATEGIES HAVE YOU IMPLEMENTED TO TRY TO OVERCOME THESE OBSTACLES?
1. locating sources of software review	Y	N	Y	N	1.	
2. obtaining & previewing copies of software	Y	N	Y	N	2.	
3. making suggestions about purchase of software	Y	N	Y	N	3.	
4. evaluating the effects of your microcomputer based instruction	Y	N	Y	N	4.	
5. getting feedback from your students on utility of program	Y	N	Y	N	5.	
6. evaluating the physical arrange-ments & scheduling of your micro-computer instruction	Y	N	Y	N	6.	
7. evaluating which curriculum objectives were best taught using the microcomputer	Y	N	Y	N	7.	
8. evaluating the FCPS program for the utilization of microcomputers	Y	N	Y	N	8	

COMMENTS: _____

APPENDIX C

Questionnaire Correspondence

Appendix C-1

February 5, 1985

Dear Fellow Teacher:

I would like to introduce myself: My name is Susan Conrad and I am a classroom teacher at Thoreau Intermediate School. In addition I am a doctoral candidate at Virginia Polytechnic Institute and State University.

As part of my doctoral dissertation, I am studying teachers' expected and actual implementation of the microcomputer in the classroom following attendance in a Fairfax County Public School sponsored microcomputer course. In order to do this, I need your help. At the same time, you will have the opportunity to report your experiences regarding the implementation of the microcomputer in your classroom.

Your name has been selected as a part of a random sample of Fairfax County Public School teachers who are being asked to participate in this study. During the next week, you will receive a copy of "A survey of Teachers' Expected and Actual Microcomputer Implementation" through the Pony. The survey can be completed in less than 25 minutes so I hope you will fit this block of time into your schedule and return it as soon as possible. One hundred percent participation is needed to insure that the results accurately represent all Fairfax County teachers using microcomputers in their classrooms. Your participation ends with the completion and return of the survey.

Your anonymity is guaranteed. The data gathered form the survey will be reported in such a manner that neither you, your school, or your principal can be associated with the findings.

This study has been approved by the Fairfax County Public School system for voluntary teacher participation. The results of this study, along with suggestions for improvement, will be made available to the Department of Instructional Services including the Office of Instructional Technology. In addition, I will send you a summary of the findings.

Your help is greatly appreciated.

Sincerely,

Susan H. Conrad

Susan H. Conrad, Teacher
Thoreau Intermediate School

Appendix C-2

February 12, 1985

Dear Fellow Teacher:

Teachers are concerned with using the microcomputer in their classrooms in as many ways possible to benefit students. In Fairfax County Public Schools, microcomputers are currently being used in schools in a variety of ways. As a part of my doctoral dissertation at Virginia Polytechnic Institute and State University, I am studying the expected and actual implementation of microcomputers in the classroom following attendance in a Fairfax County Public School sponsored microcomputer course.

You are being asked to participate in a survey that is the basis of this study. The Fairfax County Public School system has approved this study for voluntary teacher participation. The extent of your participation will be the completion and return of the survey.

Enclosed is a survey that will take less than 25 minutes of your time to complete. In order to insure the results accurately represent the experiences of Fairfax County teachers, 100 percent response is necessary so please return your survey in two weeks.

This survey is anonymous. To assure your anonymity, the survey is accompanied by a postcard. Please detach this card and drop it in the "PONY" at the same time you return your survey. This not only guarantees you and your school anonymity but will save you the bother of receiving follow-up mailings.

The results of this study will be made available to the Department of Instructional Services including the Office of Instructional Technology and highlights of the study will be sent to participants. In addition, the data will be included in my dissertation. No teacher, principal, or school will be identified at any time when reporting the results of this study.

I would like to thank you in advance for your cooperation and your time.

Sincerely,

Susan H. Conrad

Susan H. Conrad, Teacher
Thoreau Intermediate School

Appendix C-3

February 24, 1985

Dear Colleague:

As a teacher, I am sure you are aware of the importance of accurate feedback concerning the programs we implement in our classrooms. Recently you were sent a survey requesting that you supply feedback relating to your experiences with the implementation of microcomputers in the classroom in the Fairfax County Public Schools. This is a topic that is of concern to all teachers, and for the results to accurately represent the experiences of Fairfax County teachers, it is important that all participants return a survey. I have not received yours.

For your convenience, I have enclosed another copy of the survey with this letter. I urge you to take some time now to complete this and to return it to me in the pony during the next week. Please take this opportunity to report your experiences concerning the implementation of the microcomputer in the classroom. The results of this study will be made available to the Department of Instructional Services including the Office of Instructional Technology of the Fairfax County Public Schools. Thank you for your time and cooperation.

Sincerely,

Susan H. Conrad
Thoreau Intermediate School

P.S. If you have already returned your survey, and I mistakenly sent you this letter, please pardon me for bothering you again.

Appendix C-4

April 23, 1992

Dear Fellow Teacher:

Teachers are concerned with using the microcomputer in their classrooms in as many ways possible to benefit students. In Fairfax County Public Schools, microcomputers are currently being used in a variety of ways. As a part of my doctoral dissertation at Virginia Polytechnic Institute and State University, I am studying the expected and actual implementation of microcomputers in the classroom following attendance in a Fairfax County Public School sponsored microcomputer course.

You are being asked to participate in a survey that is the basis of this study. The Fairfax County Public School system has approved this study for voluntary teacher participation. The extent of your participation will be the completion of this survey.

Enclosed is a survey that will take less than 20 minutes of your time to complete. In order to insure the results accurately represent the experiences of Fairfax County teachers, 100 percent response is necessary, so please return your survey within two weeks.

This survey is anonymous. To assure your anonymity, the survey is wrapped with a blank sheet of paper with your name label on it. Please discard this sheet, complete the survey and staple/tape the survey closed so that my name and school address shows on the outside, as you'll observe it on the outside of the second sheet under the original cover. Then please drop the survey now bearing my name and school location into the "PONY" for my receipt. This guarantees you and your school complete anonymity.

The results of this survey will be made available to the School Division and highlights of the study will be sent to the participants. In addition, the data will be included in my dissertation. No teacher, principal, or school will be identified at any time when reporting the results of this study.

Thank you in advance for your cooperation and time.

Sincerely,

Susan H. Conrad

Susan H. Conrad
Teacher
Hayfield Intermediate

P.S. I thought you might enjoy a cup of coffee while completing the attached pages. Thanks again!

Appendix C-5

May 25, 1992

Hello Again!

If you've completed this survey, please disregard this mailing and thanks again for responding.

If this survey is still on your agenda of a million things to do, please take 20 minutes, if possible - maybe while monitoring exams, etc. - to complete the attached sheets.

I really appreciate your help, as I can't adequately complete my calculations without you.

Thanks again,

Your colleague,

Susan

APPENDIX D

Demographic of Implementation

Demographics

In analyzing **types of tasks** in the body of this study the 10% difference rule of thumb was used. In the analysis of the appendices differences were analyzed by **number of tasks** or in other words how many tasks regardless of types.

Table D-1 shows that by subject, math teachers implemented a greater number of tasks in 1985 than other subjects. However, all other subject teachers, especially English teachers, implemented a greater number of tasks in 1992 than in 1985.

In 1985, teachers with 3 or more years experience mostly implemented between 1-10 tasks, however those with less than 3 years experience, mainly implemented between 11-20 tasks. By 1992, a majority of categories of experience showed their most implementation in the 11-20 task area, with the 3-7 and over 20 years of experience showing most implementation in the 21-32 task area. Thus, many more tasks were implemented in 1992.

Concerning gender, Table D-2, 1985 participants regardless of gender mostly implemented between 1-10 tasks. However, in 1992 both female and male teachers implemented 11-20 tasks with males implementing most tasks overall between the 11-32 categories. Thus, a greater percentage of males in 1992 implemented than females even though a greater number of females were in the survey and employed in the county.

In 1985 of the few who implemented, all age implementation fell in the 1-10

TABLE D-1

A COMPARISON OF TEACHER IMPLEMENTATION BY CHARACTERISTICS

A. SUBJECT

# Of Tasks	Math				English				Social Studies				Special Education			
	1985%	N	1992%	N	1985%	N	1992%	N	1985%	N	1992%	N	1985%	N	1992%	N
0	19.5	15	15.9	1	66.7	24	0	0	80.0	2	0	0	42.9	6	0	0
1-10	45.5	35	41.2	7	30.6	11	0	0	16.0	4	50.0	1	49.9	7	44.4	4
11-20	29.8	23	47.1	8	2.7	1	66.6	2	4.0	1	50.0	1	7.2	1	55.6	6
21-32	5.2	5	5.8	1	0	0	33.4	1	0	0	0	0	0	0	0	0

B. YEARS EXPERIENCE

# Of Tasks	Less Than 3 Years				3-7 Years				8-10 Years				11-20 Years				Over 20			
	1985%	N	1992%	N	1985%	N	1992%	N	1985%	N	1992%	N	1985%	N	1992%	N	1985%	N	1992%	N
0	25.0	3	0	0	48.2	13	0	0	26.9	11	0	0	52.2	69	9.7	3	55.1	43	6.7	1
1-10	33.2	4	25.0	1	37.0	10	0	0	63.4	26	58.3	7	32.5	43	35.6	0	37.9	29	13.2	2
11-20	41.8	5	75.0	3	14.8	4	33.4	1	7.3	3	41.7	5	13.7	18	54.7	11	5.2	4	20.1	3
21-32	0	0	0	0	0	0	66.6	2	2.4	1	0	0	1.6	2	0	0	2.6	2	60.0	9

TABLE D-2

A COMPARISON OF TEACHER IMPLEMENTATION BY GENDER

# Of Tasks	FEMALE				MALE			
	1985		1992		1985		1992	
	%	N	%	N	%	N	%	N
0	44.4	89	7.0	4	57.0	49	0	0
1-10	41.5	83	37.0	21	30.4	26	0	0
11-20	12.0	24	40.4	23	12.6	11	66.6	4
21-32	2.2	5	15.6	9	0	0	33.4	2

A COMPARISON OF TEACHER IMPLEMENTATION BY AGE

# Of Tasks	20-29				30-39				40-49				50-59				60-69			
	1985		1992		1985		1992		1985		1992		1985		1992		1985		1992	
	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
0	44.4	4	0	0	47.8	44	14.3	2	42.6	48	8.7	2	59.0	36	0	0	57.1	4	0	0
1-10	33.3	3	0	0	36.9	39	50.0	7	43.0	47	26.0	6	36.1	21	30.4	7	42.9	6	0	0
11-20	22.3	1	100	3	15.3	14	35.7	5	11.9	15	43.7	10	4.9	3	47.9	11	0	0	0	0
21-32	0	0	0	0	0	0	0	0	2.5	4	21.6	6	0	1	21.7	5	0	0	0	0

task area. However in 1992, task implementation varied according to age. Teachers in their twenties, forties and fifties implemented more tasks than those in their thirties and sixties.

Previous microcomputer experience prior to taking the inservice course was divided into five categories. In the 1985 workshop category, Table D-3, of those who implemented, most experience levels implemented 1-10 tasks with a few of much experience implementing 11-20 tasks. By 1992, even teachers with no or little experience implemented 11-20 tasks. Only in the much category did previous computer courses boost tasks level into the 11-20 category. All others in 1985 fell into the 1-10 section. In 1992, teachers with course experience implemented in the 11-20 tasks section with those having many courses performing 21-20 tasks.

Those with none, little, and some home use experience, Table D-4, implemented 1-10 tasks, but those with much experience in 1985 implemented 11-20 tasks. In 1992, those with little experience implemented 11-20 tasks and those with much implemented 21-32 tasks. Of those who had experienced work use prior to the inservice, teachers in 1985 with none, little or some implemented between 1-10 tasks. In 1992, every category except much, implemented between 11-20 tasks, with teachers having much experience implementing 21-32 tasks. School use (D-5) in 1985 experience helped teachers implement more tasks in the some category with most falling in the 1-10 tasks section. By 1992, those with more experience implemented more tasks, with those having much experience implementing between

TABLE D-3

A COMPARISON OF IMPLEMENTATION BY TEACHER'S WITH COMPUTER WORKSHOP EXPERIENCE

	OTHER				NONE				LITTLE				SOME				MUCH			
# Of Tasks	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N
0	51.5	21	75.0	3	54.0	87	37.5	3	45.9	28	0	0	22.2	6	0	0	0	0	0	0
1-10	31.5	13	75.0	0	36.7	59	12.5	1	41.0	25	7.7	1	55.6	15	72.6	16	0	0	15	3
11-20	14.6	6	25.0	1	9.3	15	50.0	4	6.7	4	84.7	11	22.2	6	7.4	6	100	4	35	7
21-32	2.4	1	0	0	0	0	0	0	6.4	4	7.6	1	0	0	0	0	0	0	50	10

A COMPARISON OF IMPLEMENTATION BY TEACHER'S WITH COMPUTER COURSE EXPERIENCE PRIOR TO THE INSERVICE COURSE BY YEAR

	O				NONE				LITTLE				SOME				MUCH			
# Of Tasks	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N
0	44.4	12	25.8	3	59.6	93	25.0	1	44.9	20	16.7	2	32.0	16	0	0	8.6	1	0	0
1-10	48.2	13	25.0	3	34.6	54	0	0	40.8	20	2.5	3	44.0	22	57.6	15	24.9	3	0	0
11-20	7.4	2	49.0	6	4.6	7	75.0	3	14.3	7	58.3	7	24.0	12	34.8	9	58.2	7	30.8	4
21-32	0	0	0	0	1.2	2	0	0	4.0	2	0	0	0	0	7.6	2	8.3	1	69.2	9

TABLE D-4

A COMPARISON OF IMPLEMENTATION BY TEACHER'S WITH PREVIOUS COMPUTER HOME USE EXPERIENCE BY YEAR

	0				NONE				LITTLE				SOME				MUCH			
# Of Tasks	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N
0	50.0	22	50.0	3	52.7	98	27.0	2	48.3	14	0	0	26.7	8	4.0	1	0	0	0	0
1-10	38.5	17	33.3	2	37.7	69	40.0	4	44.9	13	33.4	3	39.9	12	44.0	10	20.0	1	11.0	2
11-20	11.5	5	16.7	1	8.6	14	33.0	3	6.8	0	66.6	6	23.5	7	44.0	12	80.0	4	39.0	7
21-32	0	0	0	0	1.0	2	0	0	0	0	0	0	9.9	2	8.0	2	0	0	50.0	9

A COMPARISON OF IMPLEMENTATION BY TEACHER'S WITH COMPUTER WORK USE EXPERIENCE BY YEAR

	0				NONE				LITTLE				SOME				MUCH			
# Of Tasks	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N
0	46.3	25	42.9	3	53.8	97	20.0	1	54.8	12	40.0	2	21.7	5	40.0	0	25.0	3	0	0
1-10	39.2	21	14.3	1	40.8	75	40.0	2	31.7	7	0	0	47.7	4	58.2	16	41.6	5	9.2	2
11-20	14.5	8	42.8	2	5.4	10	40.0	2	4.5	1	60.0	3	17.7	11	3.4	12	33.4	4	42.9	9
21-32	0	0	0	0	0	0	0	0	9.0	0	0	0	12.9	3	3.4	1	0	0	47.9	11

21-32 tasks more year experience. In 1992, as in the other experience categories, those with more experience implemented more tasks with those having much implementing 21-32 tasks.

Prior use, Table D-5, by the teachers in the survey areas of classroom management, instruction about microcomputer, instruction about subject and evaluation activities again showed more use in 1992 than in 1985. In 1985, of those who implemented, all implemented between 1-10 tasks in all areas. By 1992, classroom management tasks were almost evenly split between 1-10 and 11-20 tasks, with instruction about microcomputer and subject areas implementing 11-20 tasks and evaluation area task showing teacher implementation the highest in the 21-32 tasks category.

In 1985, Table D-6, those teachers who took the inservice course for voluntary, required, or recertification reasons implemented between 1-10 tasks with none taking the course for involuntary reasons. By 1992, the few who took the course involuntarily and as a requirement implemented between 1-10 tasks, while those who voluntarily took the course implemented between 11-20 tasks. No teachers took the course for recertification in 1992.

Lastly, the demographic characteristic of time lapse between taking the inservice course and implementation, Table D-7 generally shows that task implementation took place sooner in 1992 than in 1985. Over twice as many teachers by percentage implemented in 1992 than in 1985. In 1985, of those who

implemented, most implemented between 1-10 tasks. In 1992, teachers in all time period categories implemented their most tasks in the 11-20 task range.

TABLE D-5

A COMPARISON OF IMPLEMENTATION BY TEACHER'S WITH COMPUTER SCHOOL USE EXPERIENCE BY YEAR

	0				NONE				LITTLE				SOME				MUCH			
# Of Tasks	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N
0	47.9	23	28.6	2	54.3	95	25.0	1	45.2	14	22.2	2	26.7	8	4.3	1	20.0	2	0	0
1-10	39.9	19	42.9	3	38.8	68	25.0	1	42.0	13	22.2	2	26.6	8	52.2	12	40.0	3	12.6	3
11-20	10.1	5	28.5	2	6.3	11	50.0	2	12.8	4	55.6	5	36.8	11	43.5	10	40.0	4	41.7	11
21-32	2.1	1	0	0	.6	1	0	0	0	0	0	0	9.9	3	0	1	0	0	45.7	11

TABLE D-6

A COMPARISON OF IMPLEMENTATION BY TEACHER'S INITIAL REASONS FOR TAKING THE COURSE BY YEAR

	0				VOLUNTARY				INVOLUNTARY				REQUIRED				RECERTIFICATION			
# Of Tasks	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N
0	100	3	42.9	3	49.1	84	7.1	3	100	3	0	0	38.7	12	0	0	43.5	20	0	0
1-10	0	0	7.1	0	37.9	64	14.3	6	0	0	100	2	42.1	13	100	3	43.5	20	0	0
11-20	0	0	42.9	3	12.0	20	52.4	22	0	0	0	0	19.2	6	0	0	13.0	6	0	0
21-32	0	0	7.1	0	1.0	1	26.2	8	0	0	0	0	0	0	0	0	0	0	0	0

TABLE D-7

A COMPARISON OF TASK IMPLEMENTATION BY TEACHER'S TIME LAPSE IMPLEMENTATION BY YEAR

	DID NOT				0				LESS THAN 3 MONTHS				3 - 6 MONTHS				7 - 9 MONTHS				10 - 12 MONTHS				OVER 12 MONTHS			
# Of Tasks	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N	1985	N	1992	N
0	76.5	47	33.3	2	50.0	2	42.9	3	21.6	16	2.8	1	20.8	5	0.0	0	8.3	1	0.0	0	0.0	0	0.0	0	6.7	1	0.0	0
1-10	23.0	25	66.7	4	25.0	1	14.3	1	46.1	50	25.2	9	62.5	15	42.9	3	49.9	6	0.0	0	75.0	6	33.3	1	80.1	12	37.5	3
11-20	0.5	1	0.0	0	25.0	1	40.0	3	29.9	22	36.0	15	16.7	4	57.1	4	25.0	3	0.0	0	12.5	1	66.7	2	13.2	2	62.5	5
21-32	0.0	0	0.0	0	0.0	0	2.8	2	2.4	2	36.0	11	0.0	0	0.0	0	16.8	2	0.0	0	12.5	1	0.0	0	0.0	0	0.0	0

APPENDIX E

Expectation and Implementations by Number of Tasks

Expectations and Implementations

In analyzing **types of tasks** in the body of this study the 10% difference rule of thumb was used. In the analysis of the appendices differences were analyzed by **number of tasks** or in other words how many tasks regardless of types.

Teachers in 1985 and 1992 differed in the number of tasks they expected to use for Classroom Management. Table E-1 shows that teachers in 1992 expected to use more tasks than those in 1985 with the amount of 5 to 8 tasks expected use tripling from 5% in 1985 to 15% in 1992. Yet even in 1992, 40% expected to make no use of the microcomputer for classroom use. In fact, in almost all of the number of tasks, 1992 teacher expectation was markedly greater than 1985. This could be due to teachers in 1985 hoping in general to accomplish something on the microcomputer, but not really knowing what was possible.

For Instruction About the Microcomputer, Table E-2, the 1992 teachers expected to use the microcomputer for more tasks than teachers in 1985. For instance, in 1985 more than double the number of teachers as in 1992 did not expect to use any tasks in this area using the microcomputer. In 1992, almost twice as many teachers as in 1985 hoped to use the microcomputer for 1 to 4 tasks. This confidence in expected use of the microcomputer to instruct about the microcomputer may be due to the increased familiarity of teachers with the equipment and software plus the increased relevant training in inservice courses.

TABLE E-1

A COMPARISON OF EXPECTED MICROCOMPUTER USE IN MANAGEMENT TASKS

A COMPARISON OF EXPECTATION OF TASK USAGE BY AREA BY YEAR CLASSROOM MANAGEMENT

	TEACHERS	
Number of Tasks	**1985%**	**1992%**
0	52.4	38.8
1	9.9	9.0
2	16.0	6.0
3	8.8	16.4
4	7.9	14.8
5	2.0	9.0
6	1.0	0.0
7	0.0	0.0
8	2.0	6.0
	100.0	100.0

TABLE E-2

A COMPARISON OF EXPECTED MICROCOMPUTER USE IN MANAGEMENT TASKS

A COMPARISON OF NUMBER OF TASKS TEACHERS EXPECTED TO USE BY AREA BY YEAR INSTRUCTION ABOUT MICROCOMPUTER

	TEACHERS	
Number of Tasks	1985%	1992%
0	57.5	25.4
1	6.1	16.4
2	2.4	14.9
3	9.5	9.0
4	4.1	3.0
5	6.5	11.9
6	5.4	1.5
7	5.1	13.4
8	3.4	4.5
	100.0	100.0

When teachers thought about using the Microcomputer to teach about their Subject, Table E-3, in 1985 almost 15% used the microcomputer for 5-8 tasks, whereas in 1992 over 40% expected to use the microcomputer for 5-8 tasks, a higher number than for the previous areas discussed.

When 1992 teachers (Table E-4) thought about their expectations of using the microcomputer for Evaluation Activities, they expected to use the microcomputer for almost twice as many tasks (5-8) as teachers in 1985.

In 1992, teachers expected to use more tasks than in 1985 in all areas, which could be due to the increased availability of equipment and software plus revamped inservice training. In most cases in 1992, the number of expected tasks using the microcomputer was modest (1-4), but in the area of Instruction About Subject, expectations ran very high in 1992, with hopes of using 5 tasks as the most frequent response. In the area of Evaluation Activities, 1992 teacher implementation was the highest for 5-8 tasks.

Implementations

Table E-5, Classroom Management shows dramatic increase in overall implementation in 1992 as compared to 1985. Nearly 4 1/2 times as many 1992 teachers implemented tasks as in 1985. In 1985 84% teachers did not implement and in 1992 71% did implement tasks. Of those who implemented any task, in both years, most implemented at least 1-4 tasks.

TABLE E-3

A COMPARISON OF EXPECTATION OF TASK USAGE BY AREA BY YEAR

INSTRUCTION ABOUT SUBJECT

	TEACHERS	
Number of Tasks	1985%	1992%
0	37.4	11.9
1	19.9	4.5
2	12.9	3.2
3	8.8	18.9
4	6.1	18.9
5	9.5	34.3
6	0.8	3.0
7	2.5	3.0
8	2.1	2.3
	100.0	100.0

TABLE E-4

A COMPARISON OF TASK AMOUNT TEACHER'S EXPECTED TO USE BY AREA BY YEAR EVALUATION ACTIVITIES

	TEACHERS	
Number of Tasks	**1985%**	**1992%**
0	44.6	22.4
1	4.4	2.0
2	6.5	4.5
3	8.5	10.4
4	9.9	9.0
5	7.5	18.9
6	6.8	14.9
7	5.0	4.5
8	6.8	13.4
	100.0	100.0

TABLE E-5

A COMPARISON OF PERCENTAGE OF TEACHER IMPLEMENTATION BY AREA BY YEAR

CLASSROOM MANAGEMENT

	TEACHERS	
Number of Tasks	**1985%**	**1992%**
0	83.7	28.9
1	4.4	16.4
2	10.2	23.9
3	0.3	16.4
4	0.7	10.4
5	0.0	1.0
6	0.0	1.5
7	0.0	1.5
8	0.7	0.0
	100.0	100.0

When implementing tasks of Instruction about Microcomputers, Table E-6, almost two and one half times more teachers implemented tasks in 1992 than in 1985.

Teachers implemented almost three times more tasks in 1992 than in 1985 (Table E-7) when using the Microcomputer to teach about their Subject. The greatest increase in implementation was for 4, 5, and 6 tasks.

On Table E-8, Evaluation Activities, teachers implemented more than 2 1/2 times as many tasks in 1992 than in 1985 with 3 and 1/2 times as many in the 5-8 task range.

When comparing expectations to implementation of the number of tasks using the microcomputer across time (Table E-9), the number of tasks used was always lower than expected in 1985. However, in 1992, the number of tasks implemented often exceeded expectation. When looking at the distribution, the tasks most used in Classroom Management were in the 1 to 4 range, whereas, in Instruction about Subject the highest number of used tasks ranged from 4-5. This may reflect the enormous amount of subject software on the market in 1992 as opposed to classroom management software. Concerning Instruction about the Microcomputer expectations and implementation of specific numbers of tasks were closely aligned.

TABLE E-6

A COMPARISON OF IMPLEMENTATION BY AREA BY YEAR

INSTRUCTION ABOUT MICROCOMPUTER

	TEACHERS	
Number of Tasks	**1985%**	**1992%**
0	72.8	29.9
1	4.7	17.9
2	2.8	16.3
3	3.7	7.5
4	3.4	4.5
5	3.7	4.5
6	4.8	9.0
7	4.1	10.4
8	0.0	0.0
	100.0	100.0

TABLE E-7

A COMPARISON OF PERCENTAGE OF TEACHER TASK IMPLEMENTATION BY AREA BY YEAR

INSTRUCTION ABOUT SUBJECT

	TEACHERS	
Number of Tasks	1985%	1992%
0	69.4	10.4
1	9.9	7.5
2	9.2	9.0
3	3.7	14.5
4	2.7	23.9
5	2.7	22.8
6	1.2	10.4
7	0.9	1.0
8	0.3	0.5
	100.0	100.0

TABLE E-8

A COMPARISON OF NUMBER OF TASKS TEACHERS IMPLEMENTED BY AREA BY YEAR

EVALUATION ACTIVITIES

	TEACHERS	
Number of Tasks	1985%	1992%
0	66.0	20.9
1	7.1	1.4
2	3.1	6.0
3	4.8	13.4
4	5.1	9.0
5	4.1	19.4
6	2.0	14.9
7	3.4	7.5
8	4.4	7.5
	100.0	100.0

TABLE E-9

A COMPARISON OF EXPECTATIONS RELATED TO IMPLEMENTATION OF COMPUTER USE FOR NUMBER OF TEACHERS OVER TIME

CLASSROOM MANAGEMENT				
% IN 1985		Number of Tasks	% IN 1992	
Expected	Implemented		Expected	Implemented
52.4	83.7	0	38.8	28.9
9.9	4.4	1	9.0	16.4
16.0	10.2	2	6.0	23.9
8.8	0.3	3	16.4	16.4
7.9	0.7	4	14.8	10.4
2.0	0.0	5	9.0	1.0
1.0	0.0	6	0.0	1.5
0.0	0.0	7	0.0	1.5
2.0	0.7	8	6.0	0.0
100.0	100.0		100.0	100.0
INSTRUCTION ABOUT MICROCOMPUTER				
57.5	72.8	0	25.4	29.9
6.1	4.7	1	16.4	17.9
2.4	2.8	2	14.9	16.3
9.5	3.7	3	9.0	7.5
4.1	3.4	4	3.0	4.5
6.5	3.7	5	11.9	4.5
5.4	4.8	6	1.5	9.0
5.1	4.1	7	13.4	10.4
3.4	0.0	8	4.5	0.0
100.0	100.0		100.0	100.0
INSTRUCTION ABOUT SUBJECT				
37.4	69.4	0	11.9	10.4
9.9	9.9	1	4.5	7.5
12.9	9.2	2	3.2	9.0
8.8	3.7	3	18.9	14.5
6.1	2.7	4	18.9	23.9
9.5	2.7	5	34.3	22.8
0.8	1.2	6	3.0	10.4
2.5	0.9	7	3.0	1.0
2.1	0.3	8	2.3	0.5
100.0	100.0		100.0	100.0
EVALUATION ACTIVITIES				
44.6	66.0	0	22.4	20.9
4.4	7.1	1	2.0	1.4
6.5	3.1	2	4.5	6.0
8.5	4.8	3	10.4	13.4
9.9	5.1	4	9.0	9.0
7.5	4.1	5	18.9	19.4
6.8	2.0	6	14.9	14.9
5.0	3.4	7	4.5	7.5
6.8	4.4	8	13.4	7.5
100.0	100.0		100.0	100.0

APPENDIX F

Obstacles and Strategies by Number of Tasks

Obstacles and Strategies

Obstacles

As a rule of thumb differences are discussed only if there is a 2.5% task number difference.

Classroom Management

The percentage of teachers experiencing obstacles to using the microcomputer for Classroom Management for each year can be seen on Table F-1 which shows that the majority of teachers reported no obstacles in either year. This could mean that no obstacles were encountered or that the teachers did not report them. In 1985, more teachers experienced obstacles, possibly due to the lack of equipment and software. Teachers seemed to encounter more physical obstacles than support obstacles in both years. The majority of obstacles encountered in both years ranged from one to two.

In Instruction About Microcomputer, Table F-2 shows that there was a greater number of physical obstacles in 1985 and 1992 than support obstacles when teachers were instructing about the microcomputer.

Table F-3, Instruction About Subject, again shows that few teachers reported obstacles. Of those who did in 1985, most experienced between 1 to 5 physical obstacles and 1 support obstacle when teaching their subject using the microcomputer. By 1992, fewer reported physical obstacles, but more reported support obstacles.

TABLE F-1

A COMPARISON OF OBSTACLES TEACHERS EXPERIENCED BY YEAR BY TYPE CLASSROOM MANAGEMENT

1985		
Number of Tasks	**% Physical**	**% Support**
0	81.3	95.9
1	11.9	3.4
2	3.4	0.3
3	1.4	0.4
4	0.7	0.0
5	0.3	0.0
6	0.0	0.0
7	0.0	0.0
8	1.0	0.0
	100.0	100.0
1992		
Number of Tasks	**% Physical**	**% Support**
0	92.5	95.5
1	4.5	4.5
2	3.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
	100.0	100.0

TABLE F-2

A COMPARISON OF OBSTACLES TEACHERS EXPERIENCED BY TYPE BY AREA BY YEAR INSTRUCTION ABOUT MICROCOMPUTER

1985		
Number of Tasks	**% Physical**	**% Support**
0	92.9	98.0
1	4.4	1.7
2	2.0	0.0
3	0.4	0.3
4	0.3	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
	100.0	100.0
1992		
Number of Tasks	**% Physical**	**% Support**
0	92.9	98.0
1	4.4	1.7
2	2.1	0.0
3	0.3	0.3
4	0.3	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
	100.0	100.0

TABLE F-3

A COMPARISON OF OBSTACLES TEACHERS EXPERIENCED BY YEAR BY TYPE INSTRUCTION ABOUT SUBJECT

1985		
Number of Tasks	**% Physical**	**% Support**
0	85.0	97.3
1	7.3	2.4
2	4.4	0.0
3	1.7	0.3
4	0.3	0.0
5	1.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.3	0.0
	100.0	100.0
1992		
Number of Tasks	**% Physical**	**% Support**
0	97.0	94.0
1	0.0	3.0
2	3.0	1.5
3	0.0	0.0
4	0.0	0.0
5	0.0	1.5
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
	100.0	100.0

On Table F-4, Evaluation Activities, 1985 teachers reported a greater number of physical obstacles than 1992 teachers, while a greater number of support obstacles were reported in 1992.

Differences Across Years

By 1992, the county had provided added physical support in the schools for microcomputer use. Teachers only then noticed heightened needs for additional administrative support in the form of time, training, and administrative assistance. Although this type of support had always been needed to some degree, it had not been as well recognized when equipment was also lacking. With additional equipment, obviously more support as well as different kinds of support was needed. In general, the numbers of obstacles cited by teachers were rather limited. Whether these obstacles actually affected their use of microcomputers is an empirical question examined in the next section which more fully explores the relationship between implementation and obstacles.

Strategies

As a rule of thumb differences are discussed only if there is a 0.7% task number difference.

TABLE F-4

A COMPARISON OF OBSTACLES TEACHERS EXPERIENCED BY YEAR BY TYPE EVALUATION ACTIVITIES

1985		
Number of Tasks	**% Physical**	**% Support**
0	94.6	97.6
1	2.7	2.4
2	1.7	0.0
3	1.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
	100.0	100.0
1992		
Number of Tasks	**% Physical**	**% Support**
0	97.0	95.5
1	3.0	4.5
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
	100.0	100.0

Table F-5, Classroom Management, shows that more teachers reported using a greater number of strategies for classroom management activities using the microcomputer when obstacles were present in 1992 than in 1985. School strategies were mainly used in both years.

When encountering obstacles in Instruction About Microcomputer (Table F-6), in both years teachers used a greater number of school strategies than home strategies, with 1992 reporting no use of home strategies.

As teachers used the microcomputer for Instruction About Subject (Table F-7), they used a greater number of home strategies in 1985 when encountering obstacle. While in 1992, all strategies were used at school.

Table F-8, Evaluation Activities, shows the result of teachers using the microcomputer for evaluation activities. Teachers used a greater number of strategies in 1992 than in 1985, both school and home with 1985 teachers using a greater number of school than home strategies and 1992 teachers using an equal amount of school and home strategies.

TABLE F-5

A COMPARISON OF PERCENTAGE OF TEACHERS USING STRATEGIES IN CLASSROOM MANAGEMENT BY YEAR AND TYPE

1985		
Number of Tasks	**% School**	**% Home**
0	95.3	95.6
1	4.2	3.4
2	0.5	0.7
3	0.0	0.3
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
	100.0	100.0
1992		
Number of Tasks	**% School**	**% Home**
0	94.0	95.5
1	5.3	3.0
2	0.7	1.5
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
	100.0	100.0

TABLE F-6

A COMPARISON OF STRATEGIES USED BY TYPE BY YEAR BY AREA INSTRUCTION ABOUT MICROCOMPUTER

1985		
Number of Tasks	**% School**	**% Home**
0	97.3	98.3
1	2.0	1.4
2	0.7	0.3
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
	100.0	100.0
1992		
Number of Tasks	**% School**	**% Home**
0	95.5	100.0
1	3.0	0.0
2	0.0	0.0
3	0.0	0.0
4	1.5	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
	100.0	100.0
Mean =	.04	.02

TABLE F-7

A COMPARISON OF STRATEGIES TEACHERS EXPERIENCED BY YEAR BY TYPE INSTRUCTION ABOUT SUBJECT

1985		
Number of Tasks	**% School**	**% Home**
0	96.3	94.9
1	3.0	3.7
2	0.7	1.4
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
	100.0	100.0
1992		
Number of Tasks	**% School**	**% Home**
0	94.0	100.0
1	4.5	0.0
2	1.5	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
	100.0	100.0

TABLE F-8

A COMPARISON OF STRATEGIES TEACHERS USED BY YEAR BY TYPE EVALUATION ACTIVITIES

1985		
Number of Tasks	**% School**	**% Home**
0	97.7	99.7
1	2.0	0.3
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.3	0.0
7	0.0	0.0
8	0.0	0.0
	100.0	100.0
1992		
Number of Tasks	**% School**	**% Home**
0	97.0	97.0
1	3.0	3.0
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
	100.0	100.0

APPENDIX G

Obstacles and Strategies Implementation by Number of Tasks

Obstacles and Implementation and Strategies and Implementation

Table G-1 shows the results of the Classroom Management area. In 1992 a greater number of teachers implemented more tasks in the presence of obstacles than in 1985. For physical obstacles (lack of microcomputers and software) 3.8% of the 1985 teachers implemented tasks, while 6.0% of the 1992 teachers implemented tasks, even though there were more obstacles per teacher in 1992.

When teachers faced support obstacles, such as lack of resource people or lack of time, more teachers again implemented tasks in 1992 (4.5%) than in 1985 (1.0) with the amount of obstacles per teacher being approximately the same. Therefore, more professional technical support, often in the form of microcomputer lab aides and extra scheduled time for microcomputer use, helped accomplish task completion in classroom management.

However, in the area of Instruction about the Microcomputer (Table G-2), a greater number of tasks were accomplished in 1985 than in 1992. Concerning the physical obstacles, 4.2% of the 1985 teachers completed tasks with a greater number of obstacles per teacher than in 1992. Only 1.5% 1992 teachers completed tasks for which they experienced obstacles. Thus, even though there were very few microcomputers and little software present in the schools, more teachers implemented this task early. This result could be due to the fact that both students and teachers were more familiar with microcomputers in 1992 than in 1985. Thus, there was no

TABLE G-1

A COMPARISON OF TEACHER IMPLEMENTATION RELATED TO AMOUNT OF OBSTACLES BY TYPE BY YEAR

CLASSROOM MANAGEMENT

PHYSICAL

1985			1992		
# Tasks	# Teachers	%	# Tasks	# Teachers	%
0	283	96.3	0	63	94.0
1	4	1.4	1	0	0.0
2	7	2.4	2	3	4.5
3	0	0.0	3	0	0.0
4	0	0.0	4	0	0.0
5	0	0.0	5	0	0.0
6	0	0.0	6	0	0.0
7	0	0.0	7	1	1.5
8	0	0.0	8	0	0.0
	294	100.0		67	100.0
Mean =	.06			.19	

SUPPORT

1985			1992		
# Tasks	# Teachers	%	# Tasks	# Teachers	%
0	291	99.0	0	64	95.5
1	0	0.0	1	0	0.0
2	2	0.7	2	2	3.0
3	0	0.0	3	1	1.5
4	1	0.3	4	0	0.0
5	0	0.0	5	0	0.0
6	0	0.0	6	0	0.0
7	0	0.0	7	0	0.0
8	0	0.0	8	0	0.0
	294	100.0		67	100.0
Mean =	.03			.10	

TABLE G-2

A COMPARISON OF TEACHER IMPLEMENTATION RELATED TO AMOUNT OF OBSTACLES BY TYPE BY YEAR

INSTRUCTION ABOUT MICROCOMPUTER

PHYSICAL

1985			1992		
# Tasks	# Teachers	%	# Tasks	# Teachers	%
0	281	95.6	0	66	98.5
1	0	0.0	1	1	1.5
2	1	0.3	2	0	0.0
3	3	1.0	3	0	0.0
4	1	0.3	4	0	0.0
5	3	1.0	5	0	0.0
6	3	1.0	6	0	0.0
7	1	0.3	7	1	1.5
8	1	0.3	8	0	0.0
	294	100.0		67	100.0
Mean =	.21			.01	

SUPPORT

1985			1992		
# Tasks	# Teachers	%	# Tasks	# Teachers	%
0	289	98.3	0	63	94.0
1	1	0.3	1	2	3.0
2	0	0.0	2	1	0.0
3	2	0.7	3	0	1.5
4	1	0.3	4	0	0.0
5	0	0.0	5	0	0.0
6	1	0.3	6	0	0.0
7	0	0.0	7	1	1.5
8	0	0.0	8	0	0.0
	294	100.0		67	100.0
Mean =	.06			.60	

need to teach students about the microcomputer and other more advanced applications could be tried. However, when support obstacles were encountered, only 1.6 % of the 1985 teachers accomplished tasks as compared to 6.0% of the 1992 teachers. This can also be attributed to the fact that more teachers taught about the microcomputer even though they had less support because they were more familiar with the microcomputer and did not miss the support.

Table G-3 shows the results of the Instruction about Subject. The type of obstacle made a difference in the amount of implementation when comparing years. When focusing on physical obstacles, 6.7% of the 1985 teachers completed tasks with a greater number of obstacles than in 1992 when 4.5% teachers accomplished tasks. This could be due to the type of subject areas teachers were teaching. In 1985, more math teachers were newly implementing, which was the emphasis in the country at that time. From the beginning, software companies developed math software first and continued to do so. By 1992, the teachers who were taking microcomputer inservice courses were primarily English teachers. Software still had not caught up with that or other disciplines. When encountering support obstacles, more 1992 teachers implemented with a greater number of obstacles than the 1985 teachers, as again teachers were more familiar with the microcomputer and so they could overcome in the classroom or lab any deficiencies of staff, training, or time.

Table G-4 deals with Evaluation Activities. The results in this case area very close for both years when considering physical obstacles and implementation. Both

TABLE G-3

A COMPARISON OF TEACHER IMPLEMENTATION RELATED TO AMOUNT OF OBSTACLES BY TYPE BY YEAR

INSTRUCTION ABOUT SUBJECT

PHYSICAL

1985			1992		
# Tasks	# Teachers	%	# Tasks	# Teachers	%
0	274	93.2	0	64	95.5
1	6	2.0	1	1	1.5
2	8	2.7	2	0	0.0
3	0	0.0	3	0	0.0
4	2	0.7	4	1	1.5
5	3	1.0	5	0	0.0
6	1	1.3	6	1	1.5
7	0	0.0	7	0	0.0
8	0	0.0	8	0	0.0
	294	100.0		67	100.0
Mean =	.16			.17	

SUPPORT

1985			1992		
# Tasks	# Teachers	%	# Tasks	# Teachers	%
0	290	98.6	0	63	94.0
1	0	0.0	1	1	1.5
2	2	0.7	2	0	0.0
3	1	0.3	3	0	0.0
4	0	0.0	4	1	1.5
5	1	0.3	5	1	1.5
6	0	0.0	6	0	0.0
7	0	0.0	7	1	1.5
8	0	0.0	8	0	0.0
	294	100.0		67	100.0
Mean =	.04			.25	

TABLE G-4

A COMPARISON OF TEACHER IMPLEMENTATION RELATED TO AMOUNT OF OBSTACLES BY TYPE BY YEAR

EVALUATION ACTIVITIES

PHYSICAL

1985			1992		
# Tasks	# Teachers	%	# Tasks	# Teachers	%
0	285	96.9	0	65	97.0
1	1	0.3	1	1	1.5
2	1	0.3	2	0	0.0
3	2	0.7	3	0	0.0
4	0	0.0	4	0	0.0
5	3	1.0	5	1	1.5
6	1	1.3	6	0	0.0
7	1	0.3	7	0	0.0
8	0	0.0	8	0	0.0
	294	100.0		67	100.0
Mean =	.13			.09	

SUPPORT

1985			1992		
# Tasks	# Teachers	%	# Tasks	# Teachers	%
0	290	98.6	0	64	95.5
1	1	0.3	1	0	0.0
2	0	0.0	2	0	0.0
3	1	0.3	3	0	0.0
4	0	0.0	4	2	3.0
5	1	0.3	5	0	0.0
6	0	0.0	6	0	0.0
7	1	0.3	7	0	0.0
8	0	0.0	8	1	1.5
	294	100.0		67	100.0
Mean =	.24			.05	

1985 and 1992 teachers implemented approximately 3.0% tasks, even though the 1985 teachers encountered a greater number of physical obstacles. This could be due to the fact that evaluation was required both years by the Program of Studies (POS) and that in spite of the lack of equipment and software, teachers managed to complete this requirement through personal strategies. Concerning support obstacles, more 1992 teachers (4.5%) completed tasks than 1985 teachers (1.2%) even though both experienced the same amount of obstacles. This could have resulted because the 1992 teachers had more equipment and software and therefore, armed with personal knowledge and experience, were able to complete the evaluation tasks.

Strategies and Implementation

Table G-5 shows the results of the Classroom Management area. In 1992 a higher percentage of teachers implemented a greater number of tasks using strategies than in 1985. For school strategies, a little over 1% of the 1985 teachers implemented tasks, while 4.5% of the 1992 teachers implemented tasks. When teachers used home strategies to implement, the 1992 teachers, although slightly more, and the 1985 teachers implemented approximately the same number of tasks.

Table G-6 highlights the Instruction about Microcomputers area and shows that 1992 teachers implemented more tasks than the 1985 teachers when using school strategies. However, when home strategies were used, the 1985 teachers

TABLE G-5

A COMPARISON OF TEACHER IMPLEMENTATION RELATED TO AMOUNT OF STRATEGIES BY TYPE BY YEAR

CLASSROOM MANAGEMENT

SCHOOL

1985			1992		
# Tasks	# Teachers	%	# Tasks	# Teachers	%
0	290	98.6	0	64	95.0
1	1	0.3	1	0	0.0
2	2	0.7	2	2	3.0
3	0	0.0	3	1	1.5
4	1	0.3	4	0	0.0
5	0	0.0	5	0	0.0
6	0	0.0	6	0	0.0
7	0	0.0	7	0	0.0
8	0	0.0	8	0	0.0
	294	100.0		67	100.0
Mean =	.03			.10	

HOME

1985			1992		
# Tasks	# Teachers	%	# Tasks	# Teachers	%
0	290	98.6	0	65	97.7
1	1	0.3	1	0	0.0
2	3	1.0	2	1	1.5
3	0	0.0	3	0	0.0
4	0	0.0	4	0	0.0
5	0	0.0	5	0	0.0
6	0	0.0	6	0	0.0
7	0	0.0	7	1	1.5
8	0	0.0	8	0	0.0
	294	100.0		67	100.0
Mean =	.02			.13	

TABLE G-6

A COMPARISON OF TEACHER IMPLEMENTATION RELATED TO AMOUNT OF STRATEGIES BY TYPE BY YEAR

INSTRUCTION ABOUT MICROCOMPUTER

SCHOOL

1985			1992		
# Tasks	# Teachers	%	# Tasks	# Teachers	%
0	288	90.0	0	64	95.5
1	0	0.0	1	2	3.0
2	1	0.3	2	0	0.0
3	1	0.3	3	0	0.5
4	0	0.0	4	0	0.0
5	1	0.3	5	0	0.0
6	3	1.0	6	0	0.0
7	0	0.0	7	1	1.5
8	0	0.0	8	0	0.0
	294	100.0		67	100.0
Mean =	.10			.13	

HOME

1985			1992		
# Tasks	# Teachers	%	# Tasks	# Teachers	%
0	291	99.0	0	67	100.0
1	0	0.0	1	0	0.0
2	0	0.0	2	0	0.0
3	1	0.3	3	0	0.0
4	0	0.0	4	0	0.0
5	1	0.3	5	0	0.0
6	0	0.0	6	0	0.0
7	0	0.0	7	0	0.0
8	1	0.3	8	0	0.0
	294	100.0		67	100.0
Mean =	.05			.00	

implemented more tasks. This could be due to the fact that in 1985 there were fewer microcomputers in the schools, so home strategies were often the only way to solve obstacles.

When using the Microcomputer to teach a Subject area (Table G-7), again as in the previous area, 1992 teachers implemented a greater number of tasks using school strategies, but the 1985 teachers implemented a greater number of tasks using home strategies. For this area and the above area, no home strategies were used with the result of implementation in 1992.

Finally, in the evaluation activities area (Table G-8), a greater number of implementation was achieved using both school and home strategies in 1992. One way to account for this could be the fact that more evaluation was required in 1992.

TABLE G-7

A COMPARISON OF TEACHER IMPLEMENTATION RELATED TO AMOUNT OF STRATEGIES BY TYPE BY YEAR

INSTRUCTION ABOUT SUBJECT

SCHOOL

1985			1992		
# Tasks	# Teachers	%	# Tasks	# Teachers	%
0	287	97.6	0	63	94.0
1	0	0.0	1	1	1.5
2	4	1.4	2	0	0.0
3	0	0.0	3	0	0.0
4	1	0.3	4	1	1.5
5	2	0.7	5	0	0.0
6	0	0.0	6	1	1.5
7	0	0.0	7	1	1.5
8	0	0.0	8	0	0.0
	294	100.0		67	100.0
Mean =	.07			.27	

HOME

1985			1992		
# Tasks	# Teachers	%	# Tasks	# Teachers	%
0	287	97.6	0	67	100.0
1	4	1.4	1	0	0.0
2	1	0.3	2	0	0.0
3	0	0.0	3	0	0.0
4	0	0.0	4	0	0.0
5	1	0.3	5	0	0.0
6	1	0.3	6	0	0.0
7	0	0.0	7	0	0.0
8	0	0.0	8	0	0.0
	294	100.0		67	100.0
Mean =	.06			.00	

TABLE G-8

A COMPARISON OF TEACHER IMPLEMENTATION RELATED TO AMOUNT OF STRATEGIES BY TYPE BY YEAR

EVALUATION ACTIVITIES

SCHOOL					
1985			1992		
# Tasks	# Teachers	%	# Tasks	# Teachers	%
0	290	98.6	0	65	97.0
1	0	0.0	1	0	0.0
2	0	0.0	2	0	0.0
3	0	0.0	3	0	0.0
4	0	0.0	4	1	1.5
5	1	0.3	5	1	1.5
6	1	0.3	6	0	0.0
7	1	0.7	7	0	0.0
8	1	0.0	8	0	0.0
	294	100.0		67	100.0
Mean =	.09			.13	

HOME					
1985			1992		
# Tasks	# Teachers	%	# Tasks	# Teachers	%
0	293	99.7	0	65	97.0
1	0	0.0	1	1	1.5
2	1	0.3	2	0	0.0
3	0	0.0	3	0	0.0
4	0	0.0	4	1	1.5
5	0	0.0	5	0	0.0
6	0	0.0	6	0	0.0
7	0	0.0	7	0	0.0
8	0	0.0	8	0	0.0
	294	100.0		67	100.0
Mean =	.01			.07	

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VITA

SUSAN HALL CONRAD

3310 Miller Heights Road
Oakton, Virginia 22124
(703) 359-6080

OVERVIEW:

Twenty-three years experience in secondary education as teacher, administrator, school board member; in the states and overseas; public and private; American and British systems.

Officer and director in U.S. Government Agencies and financial counselor in private business.

Advanced degrees in education and history.

Organizational, managerial, computer and interpersonal skills.

EMPLOYMENT HISTORY:

Teacher, Fairfax House, Fairfax County Public Schools, Virginia, USA, November 1994 to present.

Implemented team (one of two) approach to decision making and problem solving activities of residential 7-12 program.

Program organization, equipment/materials procurement, and assembly/field trip creation.

Co-Provide all counseling and all LD/Ed services for students.

Represent the FCPS Alternative Schools on the FCPS Middle School Social Studies chair person team.

Observe and make recommendations concerning FCPS teachers through the FCPS Teacher Performance Evaluation Program (Peer Observer).

Represent FCPS alternative schools on FCPS Intervention Team.

Teacher, Area III Alternative Learning Center, Fairfax County Public Schools, Virginia, USA, September 1993 to present.

Utilize collaborative decision making (1 of 3 on team) and problem solving in innovation and implementation of the first FCPS area alternative learning center program, including 7-12 curriculum with interdisciplinary and multicultural units integrated with technology.

Program organization, equipment/materials procurement, and assembly/field trip creation.

Initiated and coordinate community service project with elementary school.

Represent the four area learning centers on the alternative AOD (alcohol and other drugs) council and on the FCPS social studies chairperson team.

Observe and make recommendations concerning FCPS teachers through the FCPS Teacher Performance Evaluation Program (Peer Observer).

Teacher, Hayfield Int., Fairfax County Public Schools, Fairfax Virginia, USA, September 1991 - June, 1993.

Researched/Prepared/Presented the POS Civics 8 Curriculum as well as co-revised curriculum activities for a Mini-Economics Fair.

Co-Led/Co-Renovated the Intermediate School Team including organization, grant procurement, objective/goal statements, and activity creation.

Co-Sponsored the school newspaper.

Represented (1 of 4) the faculty on the Faculty Advisory Council. Represented (1 of 5 on team) Hayfield Intermediate at the Virginia Middle School Association Summer Institute at Longwood College and attended the Fred Jones Seminar.

General Services Officer and Program Management Adv., U.S. Agency for Internal Development/Maputo, Mozambique, Africa (USAID/Maputo), September 1989 - July 1991.

Reorganized and directed procurement, shipping/customs, renovation/refurbishing (inventory of $3 Million), maintenance (offices/warehouses/residences), motor pool, custodian and communications/record sections into an efficient, productive unit during a period of rapid Mission expansion (largest USAID program in sub-Saharan Africa, over $100 Million).

Supervised over forty foreign service nationals.

Established management systems and procedures in Program Office which facilitated reports such as the 1990 Fiscal year Work Plan and the USAID annual report to the U.S. Congress.

Initiated and advised five member committee that founded first American School in Mozambique.

Secured $40,000 start-up grant from U.S. Department f State and directed all aspects of establishing school including negotiation and renovation of facility, recruitment of staff, curriculum development, of-shore procurement of textbooks/furnishings/ equipment, and creation of scholarship fund and recipient guidelines for local Mozambican students.

Teacher, Radford College (Secondary Level, British System), Canberra, Australia, September 1987 - January 1989.

Awarded one of the few American teaching positions permitted in the entire Australian School System.

Created Asian Studies 10 course curriculum and enhanced/presented several Secondary English courses as well as Pers. Dev. and Typing.

Instructed teachers in innovative teaching methods and computer use in teaching.

Sponsored academic activities and managed sports teams.

Administrator and Teacher, American International School of N'Djamena, Chad, Africa, September 1985 - January 1987.

Appointed as first Admin./Teacher of AISN (K-12).

Directed and organized seven member faculty than implemented the original curriculum and basic operating procedures.

Obtained $10,000 Federal Grant for creation of computer and library departments.

Resolved legal issued, designed and justified budgets to the Board, planned and procured supplies/textbooks/equipment.

Liaised with the community/country concerning all school matters.

Located and supervised renovation of alternative school site.

Teacher and Administrative Intern, Fairfax County Public Schools, Fairfax, Virginia, USA, September 1979 - January 1985.

Researched/presented history/social studies at Thoreau Int. School.

Acted as Admin. Intern for several FCPS (7-12).

Supervised George Mason student teacher.

Developed county curriculum for gifted and talented, computer literacy, and student/parent handbook.

Chaired and served on several county committees, including Superintendent's Advisory Council, Faculty Advisory Council, Textbook Selection Committee, Secondary Curriculum Council, Technology Task Force, Audit Teams, Intermediate School Study Committee.

Chosen model for FCPS Budget Media Presentation.

Designated Model For First Classroom use of Primary source material video under auspices of the National Archives, Washington, D.C.

Teacher, United Local School, Columbiana County, Hanoverton, Ohio, USA, January 1973 - January 1979.

Prepared/presented five advanced subjects.

Created and coordinated Team Teaching Program with appropriate curriculum.

Established and implemented Primary Source Material Program.

Supervised several student activities including National Honor Society, Teen of the Month Board.

Chaired several administrative/faculty committees including teacher evaluation criteria, school philosophy, final exams.

Awarded a $3,000 federal grant and $1,500 county grant for the above innovative and enriching projects.

Teacher (Substitute), Bucks County School System, Pennsylvania, USA, September 1972 - January 1973.

Presented all subject material for 7-12 classes including all core subjects and electives.

Teacher, Community School, Teheran, Iran, September 1971 - June, 1972.

Researched/Prepared/Presented the ESL English 7 & 8 and English 8 curriculum.

Created interdisciplinary units with social studies and fine arts subject areas.

Sponsored field trips and guest speakers.

Renovated school assemblies.

Teacher, Lima Senior H. S., Lima, Ohio, USA, September 1970 - June 1971.

Prepared and presented World history curriculum to five sections of tenth graders.

Sponsored the history club and related activities.

Teacher, East Gaffney Junior H. S., Gaffney, South Carolina, USA, September 1969 - June 1970.

Created the English 8 program utilizing newly approved curriculum.

Initiated the English Club and related activities.

Teacher, Greenville H. S., Greenville, South Carolina, USA, September 1968 - June 1969.

Created the Advanced Western Civilization Course which was newly mandated by the School Board, and also presented World history 10.

Coordinated history extra-curricular activities including the History Fair.

EDUCATION:

Virginia Polytechnic Institute and State University, Blacksburg, VA Doctorate Candidate (current) & CAGS (1984) in Education (Curriculum/Instruction and Administration/Supervision).

Converse College, Spartanburg, SC., Masters of Arts (1970) in Education and History.

Rollins College, Winter Park, FL., Bachelor of Arts (1968) in History and Education.

Education courses from other universities: Youngstown University, U.V.A., and George Mason University (1970-1982).

CERTIFICATION:

Type: Post Graduate Professional, State of Virginia, USA, Expiration Date: July 1, 1996.

Areas: Director of Instruction, General Supervision, Secondary Supervisor, Secondary Principal English, History, Social Science.

PROFESSIONAL:

Virginia Middle School Association, N.A.S.S.P., I.S.S.A., P.D.K., N.E.A., V.E.A., National Council for the Social Studies, Asian Teachers Association.

PERSONAL:

Computer Literate, proficient in Spanish, Portuguses and French. Interests: music, dance exercise, tennis, swimming.

REFERENCES:

Graduate & Work: Women's Center , Placement Bureau, Converse College, Spatanburg, SC, 29301; Other references furnished upon request.

PROFESSIONAL DEVELOPMENT:

TPEP Training (1994) which is helping me to assist colleagues in the ALC program as well as myself and other Fairfax teachers. TPEP will also help me in future employment situations.

Computer courses (1993-1994) including Word Perfect 5.1, Word Perfect 6.0, MAC Word Procession, Telecommunications, IBM Documents? Graphics and Claris Works which enable me to integrate technology into all subject areas and classroom activities.

Crisis Intervention Training (1993), Conflict Mediation Workshop (1993) taught me the verbal and physical skills to use in classroom disciplinary situations. I have found the verbal techniques to be most useful in the ALC program.

Multicultural Seminars (1993) which sharpened my current knowledge and unit creation skills to more thoroughly integrate multicultural aspects into the daily academic curriculum.

Fred Jones Seminar on Classroom Discipline (1992) introduced additional lesson presentation alternatives to my repertoire.

Middle School Institute (1992) updated my knowledge and techniques in working with the middle school student which I have used both in the classroom and with other professionals.

Skillful Teacher Course for Teachers (1991) which was invaluable to me, as I had just returned from overseas to FCPS and to the new evaluation system. I continue to refer to the manual for ideas and techniques and also in conjunction with TPEP.