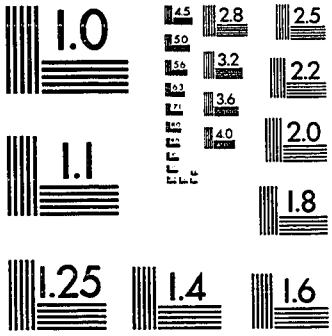


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# THE DEVELOPMENT OF A CONCEPTUAL PLANNING MODEL FOR THE USE OF COMPUTER TECHNOLOGY IN K-12 SCHOOL DISTRICTS

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# THE DEVELOPMENT OF A CONCEPTUAL PLANNING MODEL FOR THE USE OF COMPUTER TECHNOLOGY IN K-12 SCHOOL DISTRICTS

by

Harlan H. Metschke

A DISSERTATION

Presented to the Faculty of

The Graduate College in the University of Nebraska

In Partial Fulfillment of Requirements

For the Degree of Doctor of Education

Major: Interdepartmental Area of Administration, Curriculum, and Instruction

Under the Supervision of Professor C. Cale Hudson

Lincoln, Nebraska

August, 1985

# TITLE

The Development of a Conceptual Planning Model for the Use of Computer Technology in K-12 School Districts

**BY**

Harlan H. Metschke

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# THE DEVELOPMENT OF A CONCEPTUAL PLANNING MODEL FOR THE USE OF COMPUTER TECHNOLOGY IN K-12 SCHOOL DISTRICTS

Harlan H. Metschke, Ed.D.
University of Nebraska, 1985
Advisor: C. Cale Hudson

## Purpose

The purpose of this study was to develop a planning model that K-12 school district personnel could use to integrate computer applications, both instructional and administrative, into the school program.

## Procedures

The common elements of plans found in the literature to introduce microcomputers into school programs were drafted by the researcher into a planning model. That planning model was incorporated into a survey and sent to a jury of experts for validation.

The jury consisted of 17 respondents from a select group of 29 specialists in the area of educational planning and/or the use of computer data systems in education from the United States and Canada.

The data from the surveys were analyzed by calculating measures of central tendency to determine jury member

agreement with the inclusion of each component in the planning model.

## Finding

The jury validated all components of the planning model except the two that would have involved patrons without school-age children in the process.

## Conclusions

A conceptual planning model to integrate computers into the total school program should include the following major phases: 1) appointment of a task force; 2) provision for support to the task force; 3) assessment of the school district; 4) development of goals; 5) establishment of a committee structure to coordinate instructional applications, business applications, software selection, and hardware selection; 6) provision of staff inservice; and 7) evaluation of the total planning process.

This planning model is based on the concept of planning that would involve as many school constituencies as possible to develop a better product. School officials could use this model, regardless of their district's present status, to formalize their planning for computer use.

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H. H. M.

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# CHAPTER 1

# INTRODUCTION

## Context of the Problem

Schools officials in the United States have increased the number of computers they provide students for instructional purposes. A survey, completed by the National Center for Education Statistics in the fall of 1980, reported that 53,000 terminals and microcomputers were available for instructional use. By the spring of 1982 that figure had risen to 120,000 computers.[1] In the school year 1982-83, Jeanne Hayes, the president of Quality Education Data reported that the number of schools that had microcomputers in 1982-83 increased 118.3 percent over the number that had microcomputers in 1981-82. The rate of increase was 75 percent for the 1983-84 school year.[2] What has caused the rush to include computers in school programs? Have school personnel been able to systematically plan for the introduction of computers into the schools?

John Naisbitt in his best selling book Megatrends made people aware that our society had moved from an industrial

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[1] Beatrice F. Birman and Alan F. Ginsburg, "A Federal Role for Computers in the Schools," Theory into Practice, 22, No. 4 (1983), 284.

[2] Jeanne Hayes, "Microcomputers in the Public Schools," ERS Spectrum, 1, No. 3 (1983), 14.

age to an information age. He stated:

> Although computer use in public education is still in its infancy, schools around the nation are beginning to realize that in the information society, the two required languages will be English and computer."[3]

Cromer stated:

> Today, only 13 percent of the workforce is employed in industrial jobs. Less than 25 years ago, 55 percent of the nation's workers made their livelihoods from manufacturing and industry. Information, however, has replaced the mills, factories, and plants as the country's primary employer. In 1950, only 26 percent of the labor force was involved in the processing and handling of information. Currently, almost 65 percent of all workers draw their paychecks from information-related jobs.[4]

Cromer continued with a prediction.

> Manufacturing will provide only 11 percent of the jobs in the year 2000, down from 28 percent in 1980. Jobs related to agriculture will drop from 4 percent to 3 percent. The turn of the century will find the remaining 86 percent of the workforce in service-sector jobs, half will relate to information collection, management, and dissemination.[5]

One of the primary functions of the schools is to prepare young people for the world of work. As the nature of work changes, different knowledge, skills, and abilities will be necessary for the jobs available. School officials

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[3]John Naisbitt, Megatrends (New York: Warner Books, 1982), p. 25.

[4]Janis Cromer, High Tech Schools: The Principal's Perspective (ERIC ED 243 224), 1984, p. 9.

[5]Ibid., p. 13.

must be aware of these changes and make the appropriate changes in the curriculum. Vocational and college preparatory classes must be adjusted to provide students with the new skills and abilities the workforce of tomorrow will be expected to possess.

Schools officials are feeling pressure to make their curriculum relevant. The national reports on school excellence in the early 1980's added impetus to the computer revolution in schools. A Nation at Risk, the report of the National Commission on Excellence in Education, included computer literacy as one of the "new basics."[6]

The 16th Annual Gallup Poll reported the added emphasis parents now place on computer training. Sixty-eight percent of parents responding to the pollsters said that computer training should be required of all students. The jump to 68 percent in 1984 was a dramatic increase from the 43 percent of parents who thought it should be required in 1981.[7]

In spite of the dramatic increases in the number of computers in schools, the number appears inadequate.

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[6]National Commission on Excellence in Education, A Nation at Risk: Imperative for Educational Reform, (Washington: Government Printing Office, April,1983), p. 24.

[7]George H. Gallup, "The 16th Annual Gallup Poll", Phi Delta Kappan, 66, No. 1 (1984) 31.

Cromer estimated the 1984 ratio of students to computers to be 125 to 1, which limited students to spending an average of less than 20 minutes a week at the computer keyboard.[8] Pills calculated that "even with a 50 percent annual increase in microcomputers and no change in the number of older terminal systems, by 1986 there will be only about three computers per school or 1 for every 8 classrooms nationwide."[9] This limited number will not allow schools to provide instruction on computers to any appreciable degree. If computer technology is to have the desired effect on instruction, the availability of computers must continue to increase.

The rush to include technology into the classroom is not without problems. Keegan pointed out that:

> Educators are beginning to confuse the quantity of high tech instruments in their schools with the quality of education. If this view persists, the potential benefits offered by high tech will be lost. When quantity becomes the measure for quality, we end up with a process that is shallow in thought and short in commitment. Our classroom closets are filled with dust-covered technology of the 1960's and 70's. In the 1990's, they will be filled with the high technology of the 80's -- unless we focus on the primary mission of American education and decide

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[8] Cromer, op. cit., p. 26.

[9] Marcella R. Pills, The Educator's Unauthorized Microcomputer Survival Manual (ERIC ED 229 001), 1982, p. 2.

precisely where and how high technology fits.[10]

What is the appropriate use of the computer? Many districts have avoided this question, either by letting the enthusiastic teacher do whatever they wished or by simply doing what personnel in other districts were doing. In the early stages of computer use this meant running drill and practice programs and teaching BASIC, a universal computer language used with microcomputers.[11]

Eventually, simple plans for computer use began to emerge. Literature includes reports of how personnel in successful districts operationalized computers in their schools in either the administrative information area or the instructional area. A comprehensive plan for school use of computer technology has been rare. The more complete plans that do exist, as reported in the literature, are usually produced by large city school districts that employ curricular and technology specialists to coordinate the development of their district's computer technology plan. A planning model, that could be used by any size K-12 district, is needed to help plan for computer use.

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[10]John J. Keegan Jr., "The Role of High Technology in Salem Public School Classrooms," ERS Spectrum, 1, No. 3 (1983), 33.

[11]Marc Tucker, "Computers in Schools: A Plan in Time Saves Nine," Theory Into Practice, 22, No. 4 (1983), 314.

## Purpose of the Study

The purpose of this study was to develop a conceptual planning model for the utilization of computer technology in K-12 school districts. The model developed considers the planning necessary to implement administrative and instructional applications of computers into schools.

### Research Procedures.

1. The literature was examined for methods to:
    a. Establish the computer needs of a school district.
    b. Establish realistic school district goals for computer use.
    c. Identify leadership to coordinate the process of integrating computer technology into a school district.
    d. Identify a process that aids school personnel in selecting the software and hardware needed to accomplish school district goals.
    e. Determine the inservice needs of a school district staff for maximum utilization of computer technology.
    f. Evaluate the planning process and revise as necessary.
2. A planning process for integrating computers into schools was derived from the literature.
3. A jury of experts in educational planning and/or the use of computer data systems in education was selected.
4. The planning process derived from the literature was sent to members of the jury. Data indicating their agreement or disagreement with components in the planning model were collected.
5. Data were analyzed and reported.

6. A comprehensive planning model to integrate computers into the total school program was developed based on the literature and the results of the data collected from the jury of experts.

## Definition of Terms

For the sake of clarity, certain terms used in this study require definition. These terms and their definitions are:

Administrative applications. Applications of the computer used in the central office of a school district, such as: 1) budgetary accounting, 2) payroll accounting, 3) word processing, 4) data base applications, and 5) spreadsheet applications.

Computer. An electronic machine which, by means of stored instructions and information, performs rapid, often complex calculations, or compiles, correlates, and selects data.

Computer-assisted instruction. Computer-assisted instruction is a method of instruction in which a computer is used to control part or all of the selection, sequencing, and evaluation of instructional materials.

Computer-managed instruction. Computer-managed instruction is a computer-based data evaluation system designed to help teachers monitor individual student progress.

Conceptual planning model. A plan developed for use as a model from which a school district plan for the implementation of computers into the total school program can be developed. In this study, the conceptual planning model is the final model developed after the validation by the jury of experts.

Hardware. A collection of physical parts, such as mechanical and electronic devices. This includes input/output devices, main storage units, and central processing units.

Instructional management applications. Instructional computer use includes the use of a computer for one or more of the following activities: (1) computer-assisted instruction, (2) problem solving, (3) teaching computer science or data processing skills, (4) gaming and simulation of real-life situations, (5) computer-managed instruction, (6) guidance and counseling, and (7) other reported instructional applications.

Jury Members. The 17 respondents of the 29 selected specialists in educational planning and/or the use of computer data systems in education, who completed and returned the researcher's survey.

Microcomputer. A small electronic computer capable of performing the functions of a full-size computer but small enough to sit on an office desk.

Planning Model. In this study, it is the model to

plan for the integration of computer applications into schools that was extracted from the literature by the researcher.

Software. The programs, procedures, and related materials associated with efficient operation of a particular computer system.

## Assumptions

The following assumptions were advanced prior to undertaking the study:

1. There is a determinable set of planning elements that can be identified as being needed for a planning model.

2. The extent to which there is consensus concerning the degree of importance of elements contained in the planning model is an important dimension affecting its validation.

3. The procedure to be used for selection of the members of the jury will identify experts in planning for computer technology in schools and planning of programs, in general, in K-12 school districts.

## Delimitations and Limitations

This study was restricted by the following delimitations:

1. The validation of the planning model was confined to a conceptual analysis by a panel of educators with

recognized expertise in program planning and the use of computer technology in schools.

2. Jury members with expertise in the planning for computer technology in schools were delimited to respondents from the sixteen members of the 1984-1985 Board of Directors of the Association for Educational Data Systems, an international organization. Jury members with expertise in program planning were delimited to respondents from the thirteen 1985 officers and board members of the International Society for Educational Planning.

3. The literature search for this study was limited to literature published after 1979, a period which coincides with the introduction of microcomputers into schools.

This study was subject to the following limitations:

1. Validation of the planning model was limited by the perceptions of the members of the jury of recognized experts.

2. The elements included in the planning model were limited to those suggested in the literature review.

3. The elements of the planning model submitted to the jury were limited by the synthesis of the literature by the researcher.

## Significance

The purpose of this study was to provide K-12 school districts with a model to follow in developing or modifying

their district-wide computer use plan. Regardless of a district's present utilization of computers, school officials should be able to determine their district's present status relative to the model process and proceed from there.

# CHAPTER 2

# REVIEW OF SELECTED RELATED LITERATURE

## Introduction

The review of selected literature in this chapter is divided into five major sections. The first section discusses the theory of planning as it relates to education. The second section examines the planning processes that have been utilized in the introduction of computers into schools. Common elements that appear in a majority of the school plans reviewed make up the third section. The fourth section addresses the considerations that should be made at different stages of the planning process. The last section discusses considerations for computer use in the administrative information area and the instructional management area.

## The Planning Process

Planning is a process school officials have utilized to a limited degree. Constituencies, however, are demanding more planned change in schools to maintain pace with today's technical society. The schools of tomorrow must develop planning techniques to bring about the required change.

Ackoff identified planning as "one of the most complex and difficult intellectual activities in which man can

engage."[1] He defined planning as, "the design of a desired future and of effective ways of bringing it about."[2]

Ackoff classified planning into four major orientations with reference to time. He indicated that: 1) reactive planning relates to the past, 2) inactive planning relates to the present, 3) preactive planning relates to the future, and 4) proactive planning relates to the past, present, and future. Reactivists are not satisfied with the way things are or the way things are going. They exist to maintain the past. Inactivists are satisfied with the present state of affairs and are unwilling to return to the past. They also dislike the inevitable future. Preactivists attempt to accelerate change for they believe the future to be better than the present state of affairs. Although preactivists assume that the future is out of their control, they believe they can predict the future and prepare for it. Proactivists, on the other hand, see planning as the design for a desired future and work to bring about that desired future. Proactivists rely on experiments rather than experience for their solutions to

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[1]Russell L. Ackoff, A Concept of Corporate Planning (New York: Wiley-Interscience, 1970), p. 1.

[2]Ibid.

problems.[3]

Ackoff identified contingency planning as a preactive process. Possible futures are identified and then plans are developed to deal with each possible future. This planning technique is effective only if all possible futures can be identified and resources exist to prepare a solution for each.[4]

Le Breton and Henning defined planning as a predetermined course of action which contained three characteristics: 1) it must involve the future, 2) it must involve action, and 3) it must contain personal or organizational identification.[5] They provided the following procedure in developing a plan.

1. Becoming aware of a possible need for formulating a plan.
2. Formulating a precise statement of the objective of the plan to be prepared.
3. Preparing a broad outline of the proposal.
4. Obtaining approval of the proposal.
5. Organizing planning staff and assigning responsibility.
6. Determining the specific outline of the plan.
7. Establishing contact with all cooperating units.
8. Obtaining necessary data.
9. Evaluating data.
10. Formulating tentative conclusions and

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[3]Russell L. Ackoff, "Our Changing Concept of Planning," The Journal of Nursing Administration, 12, No. 10 (1982), 35.

[4]Ibid.

[5]Preston P. Le Breton and Dale A. Henning, Planning Theory (Englewood Cliffs, N. J.: Prentice-Hall, 1961), p. 7.

preparing tentative plans.
11. Testing components of tentative plans.
12. Preparing the final plan.
13. Testing the plan.
14. Obtaining approval of the plan.[6]

Planning, as viewed by Ackoff, is a continous process. A plan, therefore, is not a final product of the planning process; it is an interim report. Ackoff listed five parts he considered essential to a plan.

1. Ends: specification of objectives and goals
2. Means: selection of policies, programs, procedures, and practices by which objectives and goals are to be pursued.
3. Resources: determination of the types and amounts of resources required, how they are to be generated or acquired, and how they are to be allocated to activities.
4. Implementation: design of decision-making procedures and a way of organizing them so that the plan can be carried out.
5. Control: design of a procedure for anticipating or detecting errors in, or failures of the plan and for preventing or correcting them on a continuing basis.[7]

The planning theory reviewed above was developed in the business field. Kaufman applied a systems approach to problem solving in the field of education. He outlined the systems approach as a six step process.

1. Identify problem (based upon documented needs).
2. Determine solution requirements and solution alternatives.
3. Select solution strategies (from among the alternatives).
4. Implement selected strategy (to achieve the

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[6]Ibid., p. 14.

[7]Ackoff, A Concept of Corporate Planning, op. cit., p. 6.

required outcomes).
5. Determine performance effectiveness.
6. Revise as required at any step in the process.[8]

More responsibility for solving educational problems is being placed on officials at a local level. Arends suggested that task-force planning be applied to increase involvement from several school district constituencies.[9] The task-force planning model includes the following five phases:

1. Task force formation including recruitment of parent representatives.
2. Problem identification through some type of needs assessment.
3. New program identification and selection by matching local needs with programs proven to be effective.
4. Planning for implementation.
5. Implementation and institutionalization of the new program.[10]

Planning theory provides a framework to use in effectively creating change through people in an organizational setting. Schools must utilize planning theory and their human resources to bring about the change that society demands.

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[8]Roger A. Kaufman, Educational Systems Planning (Englewood Cliffs, N. J.: Prentice-Hall, 1972), p. 7.

[9]Richard I. Arends, "The Use of Task Force Planning for School-Based Improvement Efforts," Planning and Changing, 13, No. 4 (1982), p. 224-225.

[10]Ibid.

## Introducing Computer Use into Schools

### Nonplanning Approach

The introduction of the microcomputer into schools has been a sudden and in many cases an unplanned event. Many school districts inadvertently or intentionally adopted a grassroots approach to introducing computers. Computer buffs among the teachers learned as much as they could about computers, purchased them with district funds or out-of-school funds, and used them as they wished in their classroom. It was assumed their enthusiasm would influence other teachers until a critical mass would finally come together to develop a school-wide plan.[11]

The "computer buff" approach to introducing microcomputers had the advantage of sparing the district the cost of training personnel; however, disadvantages soon became apparent. Much money was being spent on hardware and software with only a few children in school having an opportunity to acquire computer skills. Also, without coordination those skills might not be extended in future schooling, or in fact, could be repeated.[12]

McDonald's study of the early use of microcomputers in small rural school districts exemplified the problem of

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[11] Adrianne Bank, Carol Thomas, and Richard C. Williams, The District Role in Introducing Micro-Computers: A Contingency Approach, (ERIC ED 238 943), 1983, p. 68.

[12] Ibid.

implementing computers without planning. He reported that the West Franklin, Kansas, district operated without a plan for microcomputer acquisitions.[13] The school board had purchased three partial systems, but no provision had been made for the instruction of teachers or for the care and maintainance of equipment. Furthermore, no attempt had been made to develop a scope and sequence for K-12 computer education. Such "no planning" approaches were common in the early 1980's.

Two problems exhibited in the Kansas district were the hoarding of equipment by a few, more knowledgeable, staff members and the misuse of equipment by uninformed users. To solve these problems equipment and software were centralized and inservice was provided for all teachers. Central inventory helped eliminate the hoarding of the machines by a few, helped coordinate the purchase of hardware and software, and controlled use of the computer by only those teachers who demonstrated a basic knowledge of the equipment.[14]

The limited use of microcomputers in schools was illustrated by a survey conducted through the College of Education at Arizona State University in May, 1980. Bitter

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[13]David McDonald, "A Case Study: The Rural School District and the Microcomputer," NASSP, 66, No. 455 (1982), 75.

[14]Ibid., p. 76.

found that in 37 percent of Arizona's schools computer languages were taught. Computer languages were often taught by the "computer buff" in the school, who used the microcomputer without software. Also, 26 percent of the Arizona schools were found to have personnel who were using computers to teach basic mathematic skills since an abundance of software dealing with basic skills in mathematics was available on the commercial market.[15]

The Arizona study committee concluded that most districts were finding full utilization of the microcomputer very difficult because of the lack of trained personnel and the difficulty of obtaining effective software.[16] The committee recommended:

> If the educational community is to capitalize upon the enthusiam with which this new technology has been accepted by Arizona educators, a prompt response to the current interest and need is essential.
>
> There exists, at this time, three broad areas of vital need:
>
> 1. Well trained personnel in the use and implementation of this technology.
> 2. Identification of and access to effective software.
> 3. Assistance in planning microcomputer systems and programs.[17]

In a study of the implementation of computer

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[15]Gary G. Bitter, Survey of Arizona Public School Practices and Needs for Computer Assisted Instruction, (ERIC ED 218 704), 1980, p. 2.

[16]Ibid., p. 9.

[17]Ibid., p. 9.

technology in the New York schools, it was found that microcomputers in one district's primary and middle schools were used exclusively for remediation in mathematics.[18] All of the district's computers at those levels were purchased with federal Title I funds and, therefore, were used exclusively in those programs.

Top-Down Approach

A top-down administrative style was used in Mendocino County, California, to introduce computers into the schools. School officials decided to focus on administration initially based on a belief that if administrators came to value computers, their use in classrooms would follow. Administrators believed that computers would force better management, change sloppy organizational procedures, and require a new precision in the collection, reporting, and use of information. The remarks of Mendocino County personnel indicated the frustration during the first year of implementation. "We prodded and we pushed. We identified a person in each district with enthusiasm for the project. We forced computers down their throats."[19] After the staff members

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[18]Karen Sheingold and others, Study of Issues Related to Implementation of Computer Technology in Schools, Final Report (ERIC ED 210 034), 1981, p. 24.

[19]Gareth E. Hoachlander, Computer Technology in Rural Schools: The Case of Mendocino County (ERIC ED 241 244), 1983, p. 10.

reluctantly accepted computers they admitted little basis for their initial fear of the computer.

Shared Planning Approach

Pills explained a "shared planning" approach for implementing computers into schools. This approach uses a wide range of community people to brainstorm and thus develop a "wish list" of functions the computer could perform in their school. This committee was called upon to estimate the budget necessary to fund identified applications. If funds were not available, this committee was to convince administrators and teachers to reallocate money from existing programs. The list of applications was further refined by sharing it with microcomputer users in colleges, businesses, and homes.[20]

Pills noted that the shared planning approach fell somewhere in the middle of the "no planning" approach and the top-down approach. That is, the shared planning approach involved a host of people and allowed the committee to:

> 1) Pull together existing talent and resources within your community, district, and school to guide the planning process; 2) Study your district's or school's needs and how microcomputer technology might help address them; and 3) Seek outside advice and additional information as needed to help you develop and

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[20]Marcella R. Pills, The Educator's Unauthorized Microcomputer Survival Manual (ERIC ED 229 001), 1982, pp. 20-23.

finalize your plan.[21]

Contingency Planning Approach

The contingency planning approach has been recommended for schools because of the uncertainty the rapidly changing computer technology creates. This approach suggests that a district's planning be ongoing, incremental, adaptive, and self-correcting. Contingency planning takes into consideration other likely conditions, which, if they actually occurred, would create serious difficulty for a school district. Specific actions are pre-planned for the possible occurrence of an unexpected event. These pre-planned alternatives eliminate the uncertainty and time delays that occur when the unexpected does happen.[22]

According to Bank, Thomas, and Williams, the components of a contingency approach include: 1) doing a situation audit, 2) generating support, and 3) formulating district-wide policy while developing an ongoing operational plan to facilitate decision-making.[23] The audit includes an internal inventory of the community (e.g. schools, businesses, and homes) to determine a baseline of information regarding what equipment is now available, how

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[21] Ibid., p. 20.

[22] Adrianne Bank, Carol Thomas, and Richard C. Williams, The District Role in Introducing Microcomputers: A Contingency Approach (ERIC ED 238 943), 1983, p. 75.

[23] Ibid., p. 77.

it is used, and how much it is used.[24] Also, an external audit is conducted on groups and agencies outside of the school district that might provide assistance.[25]

Generating support within the district requires obtaining commitment from individuals such as board members, parents, administrators, teachers, and industry and community leaders. Such commitment is necessary to build a policy consensus.[26] Formulating a district-wide policy framework guides the development of an operational plan by school or subject groups.[27]

Systems Planning Approach

DeGiammarino stated that the evolution of systematic planning techniques in education have aided the introduction of computers into schools. In the Lexington (Massachusetts) Public Schools, an operational plan, using the systems approach, was designed in the fall of 1979. A yearlong plan was developed by conducting a needs assessment, establishing goals for the use of computers, and developing sub-goals from the goals, objectives from the sub-goals, and action plans from the objectives. The results of an evaluation after the first year were used to

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[24]Ibid., pp. 77-78.

[25]Ibid., pp. 79-80.

[26]Ibid., pp. 80-81.

[27]Ibid., pp. 82-83.

develop a second year plan as well as a five year plan. The systems approach to planning is programmatic and requires the early involvement of many people.[28]

## Common Elements of Computer Use Plans

The literature indicated that after several years of microcomputer operation in schools, plans for their use began to emerge that were more sophisticated. The elements that appeared consistently in a large portion of the plans were: 1) the establishment of a computer planning committee; 2) an assessment of needs; 3) the establishment of goals for the plan; 4) the identification of key people to be the catylyst for computer introduction; 5) an assessment of software necessary for the plan to succeed; 6) the identification of hardware to support the software applications; 7) the provision of staff inservice to bring about desired change; and 8) the constant evaluation of the entire process.

### Establishment of a Computer Planning Committee

Most plans reviewed in the literature contained agreement on the need for a committee to develop a long-range sequence of activities which organize and integrate the use of computers into the complete school program. The

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[28]Frank P. DiGiammarino, "Computers In Public Education: The Second Time Around," Catalyst for Change, 10, No. 1 (1980), 10-11.

Montgomery County (Maryland) Public Schools' Task Force for Long Range Planning for Future Use of Computer Technology was asked to develop a plan that could be the basis for decision-making for the next seven years. Their specific goals were to:

1. Assess school system management information requirements.
2. Evaluate all current and planned information systems.
3. Develop a strategic plan for the future use of technology.
4. Apply resource constraints by providing multiple options and the timetables and costs of each option.
5. Report to the superintendent with a documented long-range plan and a short-range tactical plan (1-2 years).[29]

Filliman indicated a range of activities that a school district's advisory committee must address; she provided the following list of areas to be given consideration:

1. Development of an overall philosophy.
2. Information gathering and dissemination.
3. Inservice training of staff.
4. Support personnel-instructional, technical, and inservice.
5. Policy and procedure for selection of software.
6. Sources for review of software.
7. Duplication of materials.
8. Respect for copyrights.
9. Procedure for selection of hardware.
10. Policy and procedure for cataloging, processing, and inventory of materials.
11. Security measures.
12. Insurance needs.
13. Furniture needs.

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[29] T. J. Koehler and S. M. Raucher, Long Range Planning for Computer Use : A Task Force Model (ERIC ED 225 558), 1982, p. 4.

14. Policy concerning curriculum or grade-level range.
15. Teaching of programming.[30]

Organizational Structure. Organization of a computer use planning committee can involve subcommittees which exist to coordinate different aspects of the total plan. Koehler and Raucher reported that subcommittees were formed to handle instructional, pupil services, and business services applications in the Montgomery County (Maryland) Public School. The Subcommittee on Instructional Use of Computers was responsible for direct use of computers by students and teachers in the classroom and the use of computers to support teachers and administrators in managing instruction. The Subcommittee on Pupil Services covered recordkeeping and activities related to students and school data necessary to operate the school. The Subcommittee on Business Services was responsible for administrative tasks related to personnel, finance, budgeting, and facilities planning.[31]

Hodgson reported that subcommittees were organized to handle different functions of the complete process in the Clarksville-Montogomery County (Tennesee) Schools. A System-Wide Computer Committee coordinated the complete

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[30]Paula K. Filliman, "Guidelines for Introducing Microcomputers in the Schools," Arithmetic Teacher, 30, No. 6 (1983),16.

[31]Koehler and Raucher, op. cit., pp. 4-5.

planning process but forwarded to the Instructional Computer Subcommittee concerns dealing with equipment, software, instruction and staff development. Software concerns were forwarded on to the Computer Software Review Subcommittee. Equipment concerns were forwarded to the Equipment Review Committee. These subcommittees made recommendations to the System-Wide Computer Committee and could take action only through the System-Wide Computer Committee, an arrangement meant to provide better coordination and selection of equipment and software.[32]

Committee Membership. Committee composition seemed to vary considerably. The make-up of the Montgomery County (Maryland) Public Schools Central Task Force and the Subcommittee on Business Services was exclusively from central office personnel. The Subcommittee for Pupil Services consisted of central office personnel with elementary and secondary principals. The Subcommittee on Instructional Use of Computers was the only subcommittee that included teachers.[33] The System-Wide Computer Committee and all subcommittees for the Clarksville-Montgomery County Schools included at least two

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[32]Frank M. Hodgson, Educational Computing in the Clarksville-Montgomery County Schools. A Five-Year Plan (ERIC ED 237 077), 1983, pp. 31-33.

[33]Koehler and Raucher, op. cit., pp. 4-5.

teachers.[34] The Computer Advisory Committee of the Lexington Public Schools was made up of five teachers, five curriculum specialist, two administrators, and five parents.[35]

The noticeable lack of teacher involvement in the Montgomery County Public School task force and subcommittees points to a common oversight. Tucker reported research findings, which indicate that teachers are more likely to implement a plan that they had a part in designing. Even if they were not involved with the planning, if someone like themselves was, they are more inclined to support its implementation.[36]

The use of parents on the planning committee is supported by research done by Harris on the perceptions of elementary and secondary school parents, teachers, and administrators regarding the applications of computer technology in the public schools. Harris concluded that parents perceived a greater need for further implementation of computer assisted instruction and computer literacy than did teachers and administrators; consequently, parents should be included on school and district-wide committees

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[34] Hodgson, op. cit., pp. 31-32.

[35] Frank P. DiGiammarino, "Computers In Public Education: The Second Time Around," Catalyst for Change, 10, No. 1 (1980), 10-11.

[36] Marc Tucker, "Computers in Schools: A Plan in Time Saves Nine," Theory Into Practice, 22, No. 4 (1983), 315.

for computer use. She suggested that information be shared with parents regarding the current level of computer technology implementation and goals for the future. She added that schools should use every means possible to increase parent awareness of computer uses, because informed parents provide a great source of support for the use of such technology in schools.[37]

Assessment of Needs

Whereas committee formulation is the first step to planning computer implementation, Filliman suggested that the initial phase of planning by a committee should be a needs assessment of students and staff members. School officials should have information about the percentage of students that have computers in their homes, the amount of experience students have with microcomputers, and where they obtained their experience. She indicated that officials should know if students have been identified as being gifted or in need of remedial services in mathematics or reading.[38]

Filliman suggested that school officials know if staff

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[37]Marilyn L. Harris, "The Perceptions of Selected Elementary and Secondary School Parents, Teachers, and Administrators Regarding the Applications of Computer Technology in the Public Schools," (Dissertation, University of Nebraska, 1984.)

[38]Paula K. Filliman, "Guidelines for Introducing Microcomputers in the Schools," Arithmetic Teacher, (February 1983), 17.

members have had any computer literacy training or programming experience. School officials should know whether teachers are interested in using the microcomputer for instruction, recordkeeping, and grade reporting and if they are aware of the software available for their subject area or grade level.[39]

Achey and Cutts listed the following questions for use by the computer planning committee to better understand current computer usage:

1. How many computers does the school have?
2. Where are they located?
3. How are they used? Are they used outside the school day?
4. What teachers are involved in their use?
5. What subject matters are involved?
6. It there a software budget? Amount?
7. What software is presently available:
    a. in each building?
    b. in the district?
8. What training or inservice have staff members (individuals or groups) had?
9. Is there a hardware budget? Amount?[40]

The internal and external audits discussed by Bank, Thomas, and Williams earlier in this chapter provide a picture of the trends, forces, and phenomena that have an effect on the use of computers in a district. The internal audit surveys community, school, and homes to determine a baseline of information on equipment, software, and its

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[39] Ibid.

[40] Ed Achey and Pat Cutts, Instructional Computing - A Planning Guide: Reaching for the Future (ERIC ED 228 988), 1982, p. 1.

use. The external audit inventories agencies and resources outside of the district that could aid a district's implementation of computers.[41]

Establishment of Goals

Filliman noted the major function of a computer advisory committee was to establish goals that would guide the district in its planning of computer use. With the information from the needs assessment, surveys of other school districts, and the planning literature, the committee must tailor its goals to guide the district to a vision of the future.

Filliman outlined goals for a school district. She suggested that, within three years, all teachers should be computer literate. Moreover, staff members selected to actively use computers should have been trained in an authoring language or in computer programming. A computer literacy program should be in place so that all students would be computer literate by graduation. Instruction should be computer-aided at all levels and computer programming should be included in the junior-high program.[42]

To give an idea of the scope of a school's goals for

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[41]Adrianne Bank, Carol Thomas, and Richard C. Williams, The District Role in Introducing Microcomputers: A Contingency Approach (ERIC ED 238 943), 1983, p. 75.

[42]Filliman, Loc. cit.

the use of computer technology, Hodgson listed the five-year goals of the Clarksville-Montgomery County (Tennesee) Schools as they were constructed in 1983:

1. To formulate a system-wide computer plan for classroom computing.
2. To make classroom computers available to all students.
3. To provide inservice for teaching and administrative personnel.
4. To develop software review procedures for classroom computer materials.
5. To centralize and coordinate classroom computing in the system.
6. To help students at all grade levels develop computer related awareness and career skills.
7. To provide all students including gifted, talented, and exceptional a means for expression and creativity and exploration in using the computer.
8. To help students and teachers meet the challenge of basic skills.
9. To provide current and future technology for education and instruction to classroom teachers.
10. To provide computer literacy skills for teachers, administrators and students.
11. To provide classroom computer management programs.
12. To provide classroom individualization for students.
13. To develop a sequential instructional program using integrated computer programs and instructional materials in the classroom.[43]

Identification of Key Personnel

Schools that have successfully integrated computers into their programs can identify key staff members who played a key role in the process. Wilson ranked

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[43]Frank M. Hodgson, Educational Computing in the Clarksville-Montgomery County Schools (ERIC ED 237 077), 1983, p. 4.

identifying interested personnel as the most important ingredient for integrating computers into the curriculum of schools. She proposed that if coordinated computer growth is to occur within a district, motivated people must be available at every level of the school organization.[44]

Filliman contended that in the early plans for computer use in schools, the key people were generally teachers or administrators who had conducted their own personal investigations into the use of computers. As planning became more sophisticated, these key people were grouped into a computer advisory committee.[45]

Sheingold defined the computer buff as a teacher who was "not only interested and knowledgeable about microcomputers, but played a central role in spreading the innovation."[46] Sheingold suggested that the buffs were found in some school districts and not in other similar districts because they burned out, and left for better paying jobs in industry, or were being institutionalized by

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[44]Kara Gae Wilson, "Administrative Guidelines for Introducing Computers into the Curriculum," NASSP Bulletin, 66, No. 455 (1982), 7.

[45]Paula K. Filliman, "Guidelines for Introducing Microcomputers in the Schools," Arithmetic Teacher, (February 1983), 16.

[46]Karen Sheingold and others, Study of Issues Related to Implementation of Computer Technology in Schools, Final Report (ERIC ED 210 034), 1981, p. 102.

the formal planning that was occurring in the schools?[47]

Consultant. Some school districts have found the services of a consultant helpful in getting their planning committee started. Consultants can walk the committee through the planning process which eliminates wasted time in wondering what to do. They can help the committee set up ground rules, establish objectives, and remain on task until completion. The consultant can provide research and help the planning committee filter out approaches inappropriate for their objectives.[48]

Assessment of Software Needs

The early plans for introducing computers to schools included little more than purchasing a computer and hoping the computer enthusiasts would take it from there. Many districts found their investment in computers gained them little, because they were grossly under budgeted for software, maintenance, planning, technical assistance, and teacher training.[49]

Although early instructional uses of computers, such as programming and remedial mathematics programs, didn't

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[47] Ibid., p. 103.

[48] Marsha McVey, "A 'Centered' Approach to Micros," School Administrator, 4, No. 3 (1983), 14-17.

[49] Marc Tucker, "Computers in Schools: A Plan in Time Saves Nine," Theory Into Practice, 22, No. 4 (1983), 314.

require large software budgets, that situation is changing. Cromer related, "In 1983, the nation's elementary and secondary schools spent about $40 million just for microcomputer software, and that figure is projected to jump to $300 million by 1988."[50]

Literature points to the common mistake of first purchasing the computer and then later learning that the computer cannot run the software needed to operationalize a certain application. Komoski cautioned, "Don't purchase computer hardware until you have available a sufficient supply of software that is compatible with your school system's curriculum objectives"[51]

Software Selection. Realizing the large task of software selection, the school systems in Tennesee recommended that the State establish clearinghouses at six universities in Tennesee for the review and evaluation of microcomputer software. Each clearinghouse focuses on one specific area of software such as basic skills, administration, secondary curriculum, and vocational education.[52]

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[50]Janis Cromer, High Tech Schools: The Principal's Perspective (ERIC ED 243 224), 1984, p. 24.

[51]Kenneth P. Komoski, "Use These Five Ideas When Drafting Computer Policies," The American School Board Journal, 152, No. 3 (1983), 30.

[52]Frank M. Hodgson, Educational Computing in the Clarksville-Montgomery County Schools: A Five Year Plan (ERIC ED 237 077), 1983, p. 26.

In Minnesota, the Minnesota Educational Computing Consortium (MECC) was developed to aid schools in acquiring software. Schools pooled resources and developed software which was distributed to members of the consortium. In 1980, the MECC allowed non-Minnesota schools access to MECC software by paying an annual licensing agreement. MECC services have expanded; today, member schools can tailor inservice training sessions to help their teachers select software.[53]

At a national level, schools can acquire services from independent evaluation agencies to help with software selection. The Educational Products Information Exchange (EPIE) exists to provide consumers with independently researched purchasing information about educational materials. EPIE is currently providing training sessions in a seven-step software selection process. Contracts with some state agencies have brought the services of EPIE to all of the state's schools. Schools can also subscribe individually to one or more of EPIE's services.[54]

In a technical report of administrative uses of microcomputers, researchers from the College of Education of the University of Alabama suggested that, "prior to the

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[53]"MECC Service Spreads," MECC Network,1 (January 1984), 1-2.

[54]EPIE THE ANSWER To Your Questions About Educational Products, Publication of Education Products Information Exchange Institute, Water Mill, N.Y.

purchase of any important software, a potential user will be well-advised to rely on the advice of a knowledgeable colleague who has had experience with the particular package in question."[55] The researchers recommended that, unless users are proficient in programming techniques, they should patronize only well-established software houses and reputable dealers. A buyer should assume that a defect exists someplace in the software or in the interaction of the software with the hardware. The Alabama Center for Evaluation at the University of Alabama found that of more than fifty programs previewed, not one was without flaws.[56]

Nelson suggested getting a thirty-day trial to review all programs. At the Ralston (Nebraska) Public School, programs are ordered only if the seller will allow the school a thirty day review period. Nelson admitted the loss of software vendors because of the restriction, but believed the high percentage of poor programs on the market and the high cost of software warranted the restriction.[57]

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[55] Administrative Uses of Microcomputers: A Technical Report (ERIC ED 221 946), 1982, p. 8.

[56] Ibid.

[57] Marlin D. Nelson, "Computer Technology in the Ralston Public School," Presentation at the Nebraska Association of School Boards Convention, Omaha, Nebraska, 15 Nov., 1984.

Many school plans for computer use included the formation of a subcommittee for software review. This subcommittee had the task of reviewing all requests for software and making a recommendation for district-wide purchasing. Other plans allowed schools and staff to purchase what they believed would benefit their school or classes much like the purchases of supplemental materials. Whether left to the subcommittee or to individual staff members, purchasing software should be guided by the curriculum and not be left to individual interest or discretion.[58]

Hodgson gave six performance criteria on which to evaluate software: 1) directions, 2) instructional organization, 3) consistency, 4) help functions, 5) error handling, and 6) reactions to wrong student responses. Hodgson further explained that good software should be self-directing. Documentation should be available, but not necessary, for use of the program. Instructional organization of software should be very similar to teaching. Materials should be introduced in a logical sequence; appropriate examples should be given; and exercises with formative evaluation should be provided. Question format and request for input should be consistent.

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[58] Progress and Planning Report; K-12 Use of Computers in the Instructional Setting (ERIC ED 234 983), 1983, p. 45.

Built-in aids should answer questions for students just as if a teacher were available. The software should anticipate student errors and minimize those errors. The software should be able to alter the teaching strategy in reacting to wrong student responses.[59]

Identification of Hardware

The large number of hardware vendors and the wide variety of equipment available complicate the purchase of computer equipment to support the software selected by a school system. Some districts have placed the responsibility for hardware selection on a subcommittee. Hodgson indicated that, in the Clarksville-Montgomery County Schools, the Equipment Review Committee reviews all requests for equipment and recommends to the system-wide committee appropriate purchases.[60] Wilson grouped the questions that a hardware review committee must deal with into three categories: machine repair, machine expansion, and machine uniqueness.[61]

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[59]Frank M. Hodgson, Educational Computing in the Clardsville-Montgomery County Schools. A Five-Year Plan, (ERIC ED 237 077), 1983, pp. 15-17.

[60]Frank M. Hodgson, Educational Computing in the Clarksville-Montgomery County Schools. A Five-Year Plan (ERIC ED 237 077), 1983, p. 4.

[61]Kara Gae Wilson, "Administrative Guidelines for Introducing Computers into the Curriculum," NASSP Bulletin, 66, No. 455 (1982), 9.

Machine Repair. The equipment review committee must know the companies that manufacture the equipment and the vendors that sell the equipment. Hodgson suggested that equipment selected be manufactured by a recognized, reliable firm.[62] Pills suggested that review committees should find the answers to questions such as: Is equipment durable? Have present users found the equipment to stand up under classroom use? Is the weight appropriate in that the equipment may be moved from classroom to classroom? Will the equipment require a temperature and humidity controlled, dustless environment, free of static charges or other electronic fields? Will special electrical wiring be necessary for the computer?[63]

When concerned with repairs, the vendor plays an important part in the success of equipment selection. Pills suggested that a vendor be selected that can provide quick, reliable service. If at all possible, that service should be done locally. If repairs require extended periods, the vendor should provide a loaner system to replace the one being repaired.[64]

Machine Expansion. When purchasing a computer, the

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[62]Hodgson, op. cit., p. 9.

[63]Marcella R. Pills, The Educator's Unauthorized Microcomputer Survival Manual (ERIC ED 229 001), 1982, p. 49.

[64]Ibid., p. 31.

machine's expandability should be considered. Pills proposed that as educators use their microcomputers more they will want more memory, a second disk drive, a printer, or other peripheral devices.[65] The ability to increase the memory of a computer or to add extra devices is determined when the machine is manufactured. If expansion is possible, the buyer should know whether the additional memory or devices can simply be plugged into the computer or if expensive interface cards are necessary.[66] The number of ports a computer has limits the amount of expansion possible. Additional expansion devices include voice synthesizers,[67] plotters,[68] additional disk drives, additional memory, printers, optical readers, light pens, and modems.[69] Schools must select computers that have the expandability to include these options at a later time.

Machine Uniqueness. Certain applications require specific hardware. If graphics capabilities are necessary, a color monitor would be preferred to the less expensive

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[65] Ibid.

[66] Ibid.

[67] Ibid., p. 33.

[68] Ibid., p. 49.

[69] The Educational Administrator's Survival Guide to Administrative Uses of Microcomputers (ERIC ED 234 745), 1983, p. 10.

phosphorus green monitors used for word processing. Sound capabilities may be necessary for game playing but not necessary for accounting.[70] Most keyboards on microcomputers are similar to typewriters with the numbers located on the top row of the keyboard. If used as a calculator, a computer with the calculator pad on the keyboard would be desirable.[71] Execution time and loading speed are features that may make a machine more suitable for certain applications. Business applications generally require faster execution time and loading speed than do instructional programs. However, the speed of an instructional computer cannot be so slow that noticeable delays occur for the student.[72]

Standardization. Different opinions about the standardization of computers throughout the complete school district exist. Hodgson reported that the advisory committee of the Clarksville-Montgomery County (Tennesee) Schools recommended that "computers in the school system should be standarized in order to take advantage of circulating software throughout the system."[73] Arabia concurred saying that "the continuity from the student

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[70]Pills, op. cit., p. 12.

[71]Ibid., p. 49.

[72]Ibid.

[73]Hodgson, op. cit., p. 23.

perspective and the swap factor between district buildings, let alone the coherency of language, make one system line very desirable to start off."[74]

Searching for a single computer system to serve all school functions may not be advisable. Lengel pointed out that functions in a school's curriculum can be so different that the purchase of one computer to do all functions would be impractical. A $3,000 computer may be able to do many functions; however, if the smaller function could be done by a $300 machine, it is more practical to purchase ten $300 machines for that application than the one $3,000 computer.[75] Lengel realized the advantage of using software and hardware from different systems. Working on different configurations of machines would make students more flexible and adaptable to future computer uses.[76]

Provision of Staff Inservice

Birman and Ginsbury advised, "the success of any foray into the use of computers will depend on the training of school personnel."[77] They related the results of a

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[74]Anthony J. Arabia, "Taking the Plunge," American School and University, 55, No. 10 (1983), 19.

[75]James G. Lengel, Computer Consideration for Vermont Schools (ERIC ED 239 593), 1983, pp. 16-17.

[76]Ibid.

[77]Beatrice F. Birman and Alan F. Ginsburg, "A Federal Role for Computers in the Schools," Theory into Practice, 22, No. 4 (1983), p. 284.

survey done by the National Center for Education Statistics in 1982, in which 50 percent of the schools reported the need of a more qualified staff.[78] The National Center survey concluded that prospective teachers are not taught appropriate computer skills because it is not clear what teachers should know. The study stated, "Teachers who will be using the computer to teach subject matter will need skills very different from the skills needed by teachers of courses in computer literacy."[79]

To guarantee success in the classroom, teachers must become as familiar with the computer as their students. Wright and Stone reported the results of a study done to determine how the amount of exposure to the computer affected a teacher's feelings and thoughts about it.[80] Teachers were grouped into four levels of exposure to the computer, ranging from very little to considerable exposure. A factor analysis of the responses intended to measure feeling and wishes indicated that:

1. Exposure to microcomputers moves teachers to feel more confident, satisfied, strong about and more interested in microcomputers and, so, to think microcomputers are more enjoyable and perhaps even useful.
2. Thinking microcomputers are more enjoyable

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[78] Ibid.

[79] Ibid.

[80] Mark H. Stone and Benjamin D. Wright, Measurement as an Instrument of Learning - Final Report (ERIC ED 238 411), 1983, pp. 17-27.

moves teachers to think microcomputers are for faster learning and to want to learn more about them. This results in teachers wishing for more microcomputers.

3. Feeling more interested in microcomputers moves teachers to want to learn more about microcomputers and so to wish for more time and help with them.[81]

Providing teachers the exposure to computers is not an easy task. Cromer related, "Full implementation of computer technology in a school system is a much more complex change than the implementation of a new method of teaching reading or even the restructuring of schools from open-space to self-contained. As such, the protocol for change relating to computers is necessarily different from the change model recommended for most changes in education."[82] Cromer identified four stages of staff development for computer instruction in schools. In stage one, staff development is not considered important. What computer knowledge teachers get, they acquire from a computer store. Stage two has teachers providing the initiative for any staff development that may occur. Teachers take evening classes at universities or community colleges. Stage three involves a major commitment on the part of the school. A person is hired to coordinate the use of computer technology in the schools. Classes in

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[81] Ibid., pp. 26-27.

[82] Janis Cromer, High Tech Schools: The Principals Perspective (ERIC ED 243 224), 1984, p. 34.

programming, software evaluation, and software uses are offered. At stage four, a computer literacy course is required of all district personnel using computers.[83]

Bank, Thomas, and Williams provided the following staff development strategies to make teachers computer literate:

1. Have individual teachers, already knowledgeable, train others;
2. The school or system can provide inservice courses during or outside of class times or on inservice days;
3. Push on the state department of educaion and regional centers to offer computer training;
4. Some professional associations offer computer workshops at their meetings;
5. System can provide release time on a regular basis for teachers to take courses;
6. Provide sabbaticals for someone in the district to learn and then share expertise with others;
7. Colleges offer semester-long courses or weekend workshops;
8. Other public or private organizations, user groups, computer stores, manufacturers, and vendors offer occasional or regular workshops.[84]

Sheingold agreed that local, computer literate staff members play a large role in helping fellow teachers. Those "locals" play a critical role because they are on the scene and provide feedback to teachers as they use the

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[83]Ibid., pp. 34-35.

[84]Adrianne Bank, Carol Thomas, and Richard C. Williams, The District Role in Introducing Microcomputers: A Contingency Approach (ERIC ED 238 943), 1983, pp. 85-86.

microcomputers and experience problems.[85]

Nelson preferred an inservice instructor from outside the school district. He indicated that having an outside source lessened the fear teachers had of showing their ignorance of computers to someone they knew.[86]

At the Ralston (Nebraska) Public Schools, teachers could not have a computer in their classroom until they had completed a 15-hour computer literacy class. Although teachers paid a $60 tuition fee for the computer class, their money was reimbursed upon completion of the course.[87]

A coordinated sequence of computer inservice activities is important. Filliman stated, "the instruction time should be deliberately planned to include the essential objectives developed by the district, following the scope and sequence in the same manner expected for student training."[88] She included the following topics

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[85]Karen Sheingold and others, Study of Issues Related to Implementation of Computer Technology in Schools (ERIC ED 210 034), 1981, p. 112.

[86]Marlin D. Nelson, "Computer Technology in the Ralston Public School," Presentation at the Nebraska Association of School Boards Convention, Omaha, Nebraska, 15 Nov., 1984.

[87]Ibid.

[88]Paula K. Filliman, "Guidelines for Introducing Microcomputers in the Schools," Arithmetic Teacher, (February 1983), 17.

in the literacy course for teachers:

1. A definition of computer literacy.
2. An overview of different types of computer systems.
3. The operation of a microcomputer system.
4. The capabilities of a microcomputer.
5. The educational applications.
6. The limitations.
7. The effects of society.
8. The evaluation of software.
9. The definition of special terms-"computerese."[89]

Evaluation of the Planning Process

Evaluation is identified in the literature as an essential element of the planning process. Place and Friedlander reported that evaluation, through the work of Ralph Tyler, came to be defined as the process of comparing performance data with clearly specified objectives. Tyler outlined the procedures for evaluation as 1) identifying general objectives, 2) specifying these objectives in behavioral terms, 3) identifying situations in which the behavior could be observed, 4) devising and applying instruments for making the observations, and 5) relating the obtained evidence to professed objectives.[90]

Evaluation should be of practical use to decision

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[89] Ibid.

[90] Robert C. Pace and Richard Friedlander, "Approaches to Evaluation: Models and Perspectives," New Directions for Student Services: Evaluating Program Effectiveness, ed. Gary R. Hanson (San Francisco: Jossey-Bass, 1978), p. 4.

makers. Alkin defined evaluation as "the process of ascertaining the decision areas of concern, selecting appropriate information, and collecting and analyzing information in order to report summary data useful to decision makers in selecting among alternatives."[91]

Alkin identified five types of decisions that decision makers must be concerned about: 1) problem selection, 2) program selection, 3) program operationalization, 4) program improvement, and 5) program certification. To provide the information necessary for these decision-making situations, Alkin identified five areas of evaluation: 1) needs assessment, 2) program planning, 3) implementation evaluation, 4) progress evaluation, and 5) outcome evaluation.[92]

Stuffelbeam developed a similar decision-oriented evaluation model which has four phases: 1) context, 2) input, 3) process, and 4) product. The purpose of the context phase is to set the boundaries of the program and to describe and analyze the program being evaluated. The context phase defines the environment of the program, identifies unmet needs and unused opportunities, and analyzes why the needs and

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[91]Ibid., p. 6.

[92]Ibid., pp. 6-7.

opportunities remain unmet. Context evaluation provides a baseline of information regarding the operation and accomplishments of the total system.[93]

The purpose of input evaluation is to provide information for determining how to use resources to meet program goals and to establish a design or procedural plan for implementing the selected strategy. Methods for input evaluation include committee deliberations, review of the literature, employment of a consultant, and the pilot of an experimental program.[94]

Process evaluation is intented to detect or predict defects in the procedural design during implementation stages, to provide information for program decisions, and to maintain records of the procedures. Methodology in process evaluation includes instruments for describing the process, feedback meetings, and regular updates of the process evaluation design.[95]

The purpose of product evaluation is to measure and interpret the outcomes in relation to the

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[93]Blaine R. Worthen and James R. Sanders, Educational Evaluation: Theory and Practice (Worthington, Ohio: Charles A. Jones, 1973), pp. 136-138.

[94]Ibid.

[95]Ibid.

objectives at all phases of the program. Product evaluation provides information for deciding to continue, terminate, modify, or refocus a change activity.[96]

Kaufman, in a systems approach to planning, emphasized the need for constant evaluation, decision making, and possible revision of programs. He indicated that evaluation and revision are central to self-renewal. A self-correcting system is constantly checking to determine how well the system is doing, if it is doing what it set out to do, and how it can be improved. Kaufman indicated that revision of the system should occur as required at every stage of the planning process.[97]

Other Concerns

Other concerns of school officials in the development of a planning process to integrate computers into the school program exist. These concerns include: 1) location of equipment in the school building, 2) commitment or support that can be generated by groups within the district, 3) budget, 4) the illegal reproduction of software, and 5) the equity with which computers are provided to students.

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[96] Ibid.

[97] Roger A. Kaufman, Educational System Planning (Englewood Cliffs, NJ: Prentice-Hall, 1972), p. 21.

Location of Equipment. Location of computer equipment should be determined by program goals and objectives. Lengel described four methods of placing instructional computers in schools. The rover is a computer system placed on a wheeled cart with an extension cord, ready for use in any classroom it is moved to. This setup works well if a computer must be shared by several rooms that are located on the same floor. A computer lab has all of the school's computers located in a single room with space available to teach a complete class. The room should be arranged with dividers so single students with passes can work on individual projects. The class pet is the machine that sits in the back of a classroom. Small groups or individual students can work on the machine when their classroom schedule allows. The librarian is a computer located in the library which a single student, a group of students, or a complete class can use.[98]

In reporting research done by Henry Jay Becker, a research scientist at Johns Hopkins University, Schneider pointed out that, regardless of the many factors that are involved, the location of the microcomputer is the major factor influencing its use. He suggested keeping microcomputers out of the classroom and stated, "Putting the hardware in the classrooms means fewer teachers will

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[98]James G. Lengel, Computer Consideration for Vermont Schools (ERIC ED 239 593), 1983, p. 17.

have access to it, it will be used less often, it will get a narrower range of uses, and most of those uses will be drill-and-practice rather than programming."[99]

Becker found that, in high schools, teachers were more likely to try the computers if located in a library than in the computer lab. Students, however, made less use of the computers when located in the library than they did when located in computer labs. In elementary schools, placement of the computer in the library was the least effective approach. Becker added, "Library-based micros produce less positive learning outcomes and lower 'enthusiasm' among users."[100]

Becker found that both high school teachers and students used the moveable machines more than they did the stationary microcomputers. Although moving the machines from room to room gave the elementary students more access to the computer, those students most apt to use the computer ended up with less time on the machine.[101] Becker recommended placing computers in a lab where they produce the greatest payoff. Moving machines from classroom to classroom or locating them in the library had

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[99]Joe Schneider, "Short on Micros? Then Keep Them Out of the Classroom," NEA Today, 3, No. 1 (October 1984), 27.

[100]Ibid.

[101]Ibid.

more disadvantages than advantages. Allowing scarce computers to be located in individual classrooms, Becker emphasized, "makes absolutely no sense."[102]

When planning a computer lab, Noe suggested four areas of consideration: program needs, facilities, equipment, and finances.[103] Will the lab be used for classroom instruction, as a game center, for drill-and-practice, or for enrichment activities? The purpose of the lab will dictate its location, design, staffing, and scheduling.

Noe suggested that the room selected for the computer lab should have windows and doors that are securable and shades that eliminate glare. The room should not be near high voltage lines that might create magnetic fields and should be equipped with flooring to minimize static electricity. Ample circuits must be available to accommodate the number of machines in the room and precautions must be made to guard against voltage surges. Space requirements for work stations will require more space per station than the regular classroom.[104]

The lab setting allows planners to utilize a network system. Tucker explained that in a network system peripheral equipment can be shared by linking computers

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[102] Ibid.

[103] Margaret A. Noe, "Planning a Microcomputer Lab," School Business Affairs, 50, No. 5 (1984), p. 56.

[104] Ibid.

together with cable and appropriate communication devices. As the number of computers increase so do the economies. Such networks make it possible for a single teacher to administer test, check student progress, monitor student workstations, collect and analyze student responses, and send messages to groups of students, all without moving from a single workstation.[105]

Commitment/Support. A large group of people exist in a school district that can influence the inclusion of computers into the school's program. Bank, Thomas, and Williams listed board members, parents, administrators, teachers, and industry and community leaders as groups that can be instrumental in building a policy consensus. To generate support for including computer technology in the school's program, the authors suggested making computers available to administrators, teachers, and parents at home on weekends and holidays. Demonstrations should be available to board members, administrators, and teachers to acquaint them with operations the computer can perform and give them some hands-on experience.[106]

The board of education must provide philosophical and

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[105]Marc Tucker, "Computers in Schools: A Plan in Time Saves Nine," Theory into Practice, 22, No. 4 (1983), 318.

[106]Adrianne Bank, Carol Thomas, and Richard C. Williams, The District Role in Introducing Microcomputers: A Contingency Approach (ERIC ED 238 943), 1983, pp. 85-86.

financial support, thereby, giving the inclusion of computer technology a high-priority status.[107] Nelson reported that "the board's commitment of $100,000 and their authorization to hire a computer coordinator at the Ralston Public Schools were what really made the program work."[108]

Hoachlander noted that districts enjoying success with computers were those with a strong commitment from the school's principal or superintendent. Without a principal who would take an active role and promote the use of computers throughout the school, enthusiastic teachers soon became isolated and extensive use of the computer never materialized. Similar results occurred if the superintendent appeared unenthusiastic about computers. Although the superintendent's involvement was less direct than that of the principal, it was important that the superintendent demonstrated a belief that computers play an important part in the school's program.[109]

Parent organizations such as the PTA or PTO should be

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[107]Paula K. Filliman, "Guidelines for Introducing Microcomputers in the Schools," Arithmetic Teacher, (February 1983), 17.

[108]Marlin D. Nelson, "Computer Technology in the Ralston Public School," Presentation at the Nebraska Association of School Boards Convention, Omaha, Nebraska, 15 Nov. 1984.

[109]Gareth E. Hoachlander, Computer Technology in Rural Schools: The Case of Mendocino County (ERIC ED 241 244), 1983, pp. 13-14.

informed of the school's attempt to incorporate the computer. Hodgson reported the recommendations of the Microcomputer Curriculum Committee of the Clarksville-Montgomery County Schools to get community involvement in the school's computer program.[110] Organizations should be encouraged to purchase compatable hardware or software. Industry, business, and professional organizations should be encouraged to participate in a program where they could share their financial resources and their knowledge of computers with the school. The Microcomputer Curriculum Committee suggested the school develop a computer "clearinghouse" to share information about hardware needs, software evaluation, prices, and related information, with district patrons.[111] The committee also recommended the establishment of an annual community computer educational conference in which staff and students would provide parents and patrons with information and demonstrations of current concepts and ideas relating to computing. They recommended that courses concerning computer literacy and applications of computer technology should be provided for people in the

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[110]Frank M. Hodgson, Educational Computing in the Clarksville-Montgomery County Schools (ERIC ED 237 007), 1983, pp. 28-29.

[111]Ibid.

community.[112]

Budget. When budgeting for a school's computer technology needs, many costs are easily forgotten. The direct costs of computer hardware are relatively straight forward. The College of Education of Alabama University discussed "creep cost" in a technical report prepared in 1982. "Creep cost" took the form of unanticipated purchases of paper trays to hold printouts, extra backup disks, additional firmware, computer paper, printer ribbons, and printwheels.[113] These items can quickly add several hundred dollars to the cost of operating a $5,000 system over a year's time. Although microcomputers are very reliable, they will require maintenance from time to time. Alabama University's technical report suggested that a service contract for such a system typically cost $500 for the first year.[114] Bank, Thomas, and Williams estimated a maintenance and repair cost for microcomputers at two percent of the total equipment cost per month.[115]

Bank, Thomas, and Williams recognized costs for which the school can expect to reallocate existing resources such

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[112]Ibid.

[113]The Administrative Use of Microcomputers (ERIC ED 221 946), 1982, p. 5.

[114]Ibid.

[115]Bank, Thomas, and Williams, op. cit. p. 84.

as needs assessment and general planning, writing of specifications, dealing with vendors, evaluation of bids, supervision of installation, preparation of the site for computers, training for teachers and clerical staff, development or acquisition of software, and the maintenance and distribution of software. They suggested that the existing resources of a school in terms of personnel time and energy, staff inservice budgets, and materials and supplies budgets could be redirected to avoid additional add-on cost.[116]

Neill provided percentages that could aid in the preparation of a budget for computer equipment:

1. Equipment (basic unit) would be 66 percent of the budget;
2. Hardware peripherals, 12 percent;
3. Software, 12 percent;
4. Maintenance, 5 percent;
5. Miscellaneous, 5 percent.[117]

Neill's figures indicated that one can quickly add 50 percent or more to the base price when additional hardware is included.

Tucker also provided a rule of thumb to aid budget preparation. He suggested 25 percent for hardware, 25 percent for software, and the remaining 50 percent for planning, teacher training, technical assistance, and other

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[116]Ibid., pp. 83,84.

[117]Shirley Boes Neill, How to Plan for Effective Instructional Use of Microcomputers, Tips for Principals from NASSP (ERIC ED 236 769), 1983, pp. 83-84.

necessary support services. Maintenance of the hardware was estimated to require 2.5 percent of the budget.[118]

School officials have sought ways to decrease the initial cost of computing. The Lauderdale County School System was joined in a public consortium with five other schools in Alabama in 1968 to supply data processing needs. As the school system's computing needs increased and the present computer system became inadequate, the Lauderdale County School officials did a thorough search for alternatives. Linville and Bailey reported that the district could purchase its own system for about the same cost as the consortium fee.[119]

When acquiring computer services, school officials have several options. Splittgerber and Stirzaker outlined three such options: purchase equipment, lease equipment, or utilize a network to obtain needed services.[120] A major advantage of purchasing a system is the discount of up to 40 percent manufacturers are willing to give. The disadvantage is that as the computer becomes obsolete there

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[118]Marc Tucker, "Computers in Schools: A Plan in Time Saves Nine," Theory Into Practice, 22, No. 4 (1983), 314.

[119]Orville Bailey and Osbie J. Linville, "Lauderdale County School System's DP Solution," School Business Affairs, 50, No. 5 (1984) 56-57.

[120]Frederic L. Splittgerber and Norbert A. Stirzaker, "Guidelines for Financing School District Computer Services," School Business Affairs, 50, No. 5 (1984), p. 32.

is very little equity in the machine. The trade-in value of used computer hardware was typically from 10 to 30 percent of the initial investment.[121]

Computer services can be leased to decrease the initial financial burden of computer hardware. With a lease, charges are known and the district does not own a machine that has depreciated greatly. However, leasing computer services has disadvantages. District personnel usually pay the total cost of the equipment during the life of the agreement. Leasing also limits the flexibility administrators have since they are bound to the terms of the lease and cannot readily change the agreement until the end of the term. Lease-purchase agreements, like those used for typewriter purchases, are not generally available because of the rapidly changing computer technology.[122]

By networking, school officials can lease computer services from another district, a regional cooperative, or a state-wide network.[123] A districts microcomputer can be connected to a host mainframe computer via the telephone line to download software. A microcomputer can also be used as a terminal to communicate with the mainframe computer and the results returned to the microcomputer

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[121] Ibid.

[122] Ibid., p. 80.

[123] Tucker, op. cit., p. 318.

"terminal." Tucker estimated:

> Within a year, it will be possible to purchase from your telephone company, at least in some locations, all the computing and communications power you need, paying only for the time and storage space you use in their computers. It may be that, for many applications, a district need only purchase or lease very inexpensive terminals to gain access to enormous computing power for a very low capital expense and modest operating costs, and enjoy the additional benefit of not having to worry about equipment compatibility or obsolescence.[124]

Software Piracy. Chion-Kenney illustrated a problem that is curtailing the availability of software to schools. The illegal reproduction of copyrighted software "threatens to endanger the fragile educational-software industry."[125] At the heart of the problem is the ease with which computer software can be copied. Many school districts have provided educators with computers but have not provided adequate funds for software. Those who copy programs illegally may be the teachers who want the best for their students.[126]

Teachers who copy computer software are often ignorant about the copyright law. Chion-Kenney pointed out that it

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[124]Ibid.

[125]Linda Chion-Kenney, "Some Educators Adopting Policies to Discourage Software Piracy", Education Week, (December 12, 1984), 11.

[126]Linda Chion-Kenney, "Piracy Limits School Market's Growth, Analysts Say at Parley," Education Week, (December 12, 1984), 11.

is illegal:

1. to copy software programs onto blank disks.
2. to use the archival disk allowed for, under the copyright law, for any purpose other than as a back-up if the original disk is mistakenly damaged or destroyed.
3. to facilitate the "proliferation of simultaneous users" by loading the same piece of software into several microcomputers for use by many students at one time.[127]

The International Council of Computers in Education (I.C.C.E.) developed a suggested policy on software copyright that state and local boards could use as a model in proposing their own policies. In accordance with the I.C.C.E. policy, boards would remove legal and insurance protection for violators and would provide students with instruction about the ethical and practical problems with software piracy.[128]

Equity. Bank, Thomas, and Williams reported the results of several studies that dealt with the equity issue of computer availability for all students in schools. A survey conducted by Market Data Retrieval in 1982 found that 80 percent of the 2,000 largest, richest high schools used microcomputers, but only 40 percent of the smaller,

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[127] Ibid.

[128] Chion-Kenney, "Some Educators Adopting Policies to Discourage Software Piracy", op. cit.

poorer high schools had them.[129] Bank, Thomas, and Williams also indicated an inequity in the use of computers. In suburban districts, computers were used predominantly for programming and computer awareness. In less affluent, inner-city and rural schools, computers were used mainly for drill-and-practice and remediation.[130]

A case study in three New York schools also illustrated the equity issue. Sheingold reported that at the elementary level of one of the schools, the computers were used only by students who performed below grade level. Because the computers were purchased with federal funds, their use was limited to the students who qualified for those programs.[131] At the other two elementary schools, more computers were unintentionally provided for one school than the other because they were funded in each school by parent organizations. In essence, inequitable access to computers existed because the richer community could provide them.[132]

## Considerations Specific to Certain Applications

Splittgerber and Stirzaker categorized school

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[129] Bank, Thomas, and Williams, op. cit., p. 69.

[130] Ibid., pp. 69-70.

[131] Karen Sheingold and others, Study of Issues Related to Implementation of Computer Technology in Schools (ERIC ED 210 034), 1981, p. 101.

[132] Ibid.

applications of computers into administrative information and instructional management.[133]

Administrative Information

Many of the computer applications used in schools today developed due to reporting requirements of local, state, and federal agencies. Vast amounts of information on students, personnel, and programs are necessary to complete reports. The College of Education of Alabama University estimated that eight percent of a school district's operating budget can be directly attributed to administrative reporting requirements.[134]

Computers purchased for administrative uses are often justified by savings from lowered clerical personnel cost and enhanced administrative productivity. Malinconico reported that the most likely outcome of introducing a computer system is the failure to achieve any anticipated savings, especially in nonprofit organizations.[135] He noted that most nonprofit organizations function with a minimal staff and provide minimal services. The time saved

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[133]Frederic L. Splittgerber and Norbert A. Stirzaker, "Guidelines for Financing School District Computer Services," School Business Affairs, 50, No. 11 (1984), 32.

[134]The Administrative Uses of Microcomputers, A Technical Report (ERIC ED 221 946), 1982, p. 2.

[135]Michael S. Malinconico, "Technology and Productivity," Library Journal, 108, No. 10 (1983), 978.

by using computers simply allows personnel to complete other needed functions. The situation before and after the introduction of computers is impossible to compare. Malinconico concluded, "a clear description of the benefits to be derived from new technology must serve in lieu of economic arguments in justifying it."[136]

Splittgerber and Stirzaker classified the administrative applications of computers into four categories: 1) staff personnel, 2) finance/accounting, 3) administrative support services, and 4) pupil personnel. Staff personnel included applications such as sick and personal leave, certification, insurance, and fringe benefits. Included in the finance/accounting category were supply and equipment inventories, auditing, building repairs, and maintenance. Administrative support services included applications in transportation, food services, and health services. The pupil personnel category consisted of enrollment data, student records, and placement and discipline information.[137]

A large listing of possible administrative applications was provided by Stevens and Sybouts in a 1984 report to the Board of Education of the Arlington

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[136]Ibid., p. 980.

[137]Splittgerber and Stirzaker, op. cit.

(Nebraska) Public Schools.[138] For example, in the finance/accounting category, they included budget management, payroll, purchasing/biddings, and activities accounting applications; and, in the pupil services category, they included scheduling, the planning and management of IEP's, grade reporting, student advisement, and health records (see Appendix A for a complete listing).

Stevens and Sybouts noted a distinction between administrative applications that can be done "inhouse" on a mini or microcomputer and those that can be contracted more economically from an outside provider of such services. They suggested it might be more economical for a small school district to contract for the administrative applications that require more complex computer systems with greater capacity and more skilled personnel to operate them. Contracting for major services also lessens the dependency a school district has on trained personnel, who if they should decide to change jobs, could leave a complex system inoperable. The disadvantages must be weighed against the flexibility provided by owning a computer system. Stevens and Sybouts suggested that the choice is not an either/or situation, some applications can be done "inhouse" while others can remain a contracted

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[138]Dorothy J. Stevens and Ward Sybouts, "Computer Analysis, Arlington Public Schools," Unpublished Report to the Board of Education of the Arlington Public Schools, Arlington, Nebraska, 1984, p. 14.

service.[139]

Administrators can easily get caught up in the excitement created by computer technology and attempt to automate the administrative offices too quickly. Alabama University's Technical Report warned,

> While there is no lack of possible work for such a machine, the administrator who attempts to automate a variety of tasks simultaneously will likely produce chaos in the front office. A system that is implemented improperly or hastily will add to the work of the office staff.[140]

Instructional Management

Oliver supplied two reasons why administrative information applications have been more readily accepted than instructional uses: 1) instructional uses require a larger number of computers or terminals, and 2) school officials have not clearly defined the role computers are to play in the instructional program.[141]

Hill suggested two questions that teachers should answer as they plan for the use of a computer program:

1. How do the software I select and the computer activities I plan contribute to meeting the objectives of my class and my school?
2. Does my instructional plan take advantage of the unique potential of the computer; is

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[139] Ibid., pp. 13-14.

[140] The Administrative Use of Microcomputers, A Technical Report, op. cit., p. 3.

[141] Clarence G. Oliver Jr., "Facing the Challenge: Directions, Difficulties of the First 'Byte'," NASSP Bulletin, 66, No. 455 (1982), 3.

> there a clear advantage over other media in attainment of the particular goal?[142]

Teachers should not be allowed to locate a program in their subject area and then build their class objectives to suit that program. Teachers must be aware of the different types of instructional applications if they plan to integrate computers into the curriculum. Pills categorized instructional applications into: 1) drill and practice, 2) tutorial dialogue, 3) simulations, 4) computer programming, 5) instructional management, and 6) computer literacy.[143]

Drill and Practice. Pills described "drill and practice" as an application in which the computer program provides a question, the student supplies an answer, and the computer program indicates whether the student's response is correct. Drill and practice programs provide interaction with students and supply students with immediate feedback; but the programs fail to give any explanation of why the student's answer is wrong.[144]

Tutorial Programs. According to Pills tutorial programs do not include the repetitive questions asked in

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[142]Shirley A. Hill, "The Microcomputer in the Instructional Program," Arithmetic Teacher, (February 1983), 14.

[143]Marcella R. Pills, The Educator's Unauthorized Microcomputer Survival Manuel (ERIC ED 229 001), 1982, p. 10.

[144]Ibid.

drill and practice programs; instead, they present concepts to the user. Tutorial programs can monitor a student's progress, introduce review segments if a student is having trouble, or even skip material. Pills noted that such branching requires an enormous amount of programming and instructional technology, which makes simulation programs more difficult to produce and more expensive to purchase. For these reasons most existing tutorial programs were found to be of a simpler nature.[145]

Simulation. Pills recognized the value of simulation programs which provide situations that would normally be too complex and too expensive for students to experience in the classroom. Because of their complexity, however, few simulation programs are available. Few of the existing simulation programs are available with the support material necessary to integrate them into a school's curriculum.[146]

Computer Programming. Computer programming is the writing of a sequence of instructions, in a language the computer can utilize, to perform a certain task. Pills noted the debate about programming being a basic skill of the future and whether all students should devote the time

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[145]Ibid., p. 11.

[146]Ibid.

necessary to become proficient at a language?[147]

Moursund stated that students, when first encountering computers and a programming language

> must focus upon learning the rudiments of a programming language. But eventually enough of the language is learned to open up new worlds for exploration and learning. If the computer and language system are appropriately designed, most students can move rapidly from an emphasis on the study of the computer language to an emphasis on learning other materials.[148]

In Mendocino County, California, school officials have no illusions about training future programmers. Hoachlander advocated, "teaching BASIC (a computer language) provides a means to teach students logic and systematic thinking in a way they find exciting. Programming is problem solving, a skill that will last a lifetime."[149]

Student time would be better spent, according to Tucker[150] and Keegan,[151] learning a wide range of

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[147]Ibid., p. 14.

[148]David Moursund, School Administrator's Introduction to Instructional Use of Computers (ERIC ED 240 700), 1983, p. 26.

[149]Gareth E. Hoachlander, Computer Technology in Rural Schools: The Case of Mendocino County (ERIC ED 241 244), 1983, p. 19.

[150]Marc Tucker, "Computers in Schools: A Plan in Time Saves Nine," Theory into Practice, 22, No. 4 (1983), p. 316.

[151]John J. Keegan Jr., "The Role of High Technology in Salem Public School Classrooms," ERS Spectrum, 1, No. 3 (1983), 34-35.

computer applications rather than learning the skill of computer programming. Keegan proposed that students need to be aware of how the computer functions.

> This can be accomplished through a short (eight week) introduction to programming -- just enough so that students understand how to make the machine perform fundamental operations. The remainder of the course should be spent introducing students to the four major uses of the computer outside of programming: word processing, electronic spreadsheets, data base (file) management, and graphics.[152]

Instructional Management. Instructional management applications of computers have been described by Pills as those which use administrative information to determine what should be taught. Instructional management programs can manage test performance information and other student scores to plan for future instruction of individual students. Microcomputers can be programmed to generate and administer individual tests for students.[153]

The development of Individual Education Plans (IEP) for special education students is a good example of an instructional management application that is used by many schools. Hoachlander detailed the process:

> In developing the IEP with the student and parent, the teacher simply informs the computer (by number) what objectives have been selected. The computer then produces a printout that lists for each area of the curriculum the annual goal,

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[152] Ibid., p. 35.

[153] Pills, op. cit., p. 15.

> short term objectives, achievement criterion, and the date by which success is sought. A copy is produced for the parent, and the entire IEP is stored on the computer so that the status of each objective can be monitored. The program eliminates the tedium from the preparation of the plan, allowing the teacher, the student, and the parent to concentrate on developing very specific program objectives.[154]

Computer Literacy. Computer literacy is an application with a wide range of meanings. Pills categorized computer literacy into three classes: 1) computer applications, 2) computer-related information skills, and 3) programming.[155] Computer applications make students aware of the ways computers can be used in various careers. Computer-related information skills introduce students to the use of word processing programs and data-base programs. Students use a computer program and such skills as typing and writing to accomplish a certain task. Programming is the upper extreme of computer literacy.

Computer literacy was described by Moursund to have three levels of knowledge. The first two levels, the awareness level and the functional level, are addressed in pre-college education. The awareness level can start in elementary school. The functional level requires some instruction with programming and actual work with special

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[154]Hoachlander, op. cit., p. 26.

[155]Pills, op. cit., pp. 12-13.

use commercial programs, such as a word processor, a spread sheet, or a data base program. The third level of knowledge, the professional level, is usually acquired in a postsecondary educational institution. The professional level of knowledge is a large step above the functional level of knowledge taught in high school.[156]

Scope and Sequence

Equally important to deciding what instructional applications to integrate into the curriculum is at what level should applications be applied. Neill reported a three step approach provided by Brumbaugh and Rawitch of the Minnesota Educational Computing Consortium to aid with that decision:

1. Analyze the current curriculum, perhaps by subject area, to identify content, skills, and attitudes. This represents what educators want to do for students.
2. Determine what kinds of instructional activities are possible using computers.
3. Compare the curriculum desires with the computer capabilities to find where matches occur. These are the places where computing fits the curriculum. There are many areas of the curriculum where computing does not fit.[157]

Lengel suggested use of a matrix to determine at what grade level different computer instructional applications

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[156]Moursund, op. cit., pp. 29-31.

[157]Shirley Boes Neill, How to Plan for Effective Instuctional Use of Microcomputers, Tips for Principals from NASSP (ERIC ED 236 769), p. 3.

should be considered (see Appendix B). Each school district planning committee should develop its own matrix. With the instructional applications as one dimension and the grade level as the other, the committee can indicate at what grade level it thinks that application is appropriate. As new applications are recognized, they can be included in the matrix to aid in planning.[158]

Splittgerber and Spirzaker noted that a common mistake of school district personnel has been to plan for their computer needs in piecemeal fashion. To get a comprehensive picture, the computer needs of administrative information and instructional management must be identified at the district level. Only then can a district-wide master plan insure that all critical needs are being met.[159]

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[158]James G. Lengel, Computer Considerations for Vermont Schools (ERIC ED 239 593), 1983, p. 5.

[159]Fredric L. Splittgerber and Norbert A. Stirzaker, "Computer Technology for Administrative Information and Instructional Management in School Districts," Education Technology, 24, No. 2 (1984), 36.

# CHAPTER 3

# METHODOLOGY

## Introduction

Information in this chapter describes the process used to validate the planning model developed from the literature, the instrument used to collect the data during the validation process, and the analysis of the data collected. The research procedure, as presented in Chapter 1, was divided into two major parts: 1) the development of the planning model, which was incorporated into the survey instrument, and 2) the validation of this planning model by a jury of experts.

## Validation

Thirteen planning experts, the 1985 officers and board members of the International Society for Educational Planning (ISEP), and 16 experts in the use of computer technology in schools, the 1984-85 board of directors of the Association of Educational Data Systems (AEDS), were asked to validate a model for planning the integration of computers into K-12 schools. The planning model was drafted from the literature by the researcher. Nine of the ISEP members and eight of the AEDS members participated as the jury to validate the planning model (See Appendix E for a complete listing of jury members).

The ISEP was founded in 1970 in Washington, D.C. to foster the professional knowledge and interest of educational planners. The membership of ISEP includes persons from the ranks of governmental agencies, school-based practitioners, and higher education. The AEDS is an international organization founded in 1962 to advance educational applications of technology. Members of AEDS include educators and technical experts who were interested in the use of computers in education and who represented public and private schools, higher education, and state/provincial departments of education.

The design chosen for this study facilitated the development of a planning process to implement computers into schools that incorporated the expert opinion of educational planners and educational computer data system users. These experts were chosen by their peers to lead their respective organizations. A canvas-type survey was conducted as opposed to a sample-type survey since the governing boards of the two organizations represented both public schools and post-secondary educational institutions in a wide range of regions of the United States and Canada.

## Instrumentation

A review of the literature on the development of a

planning model revealed a survey, designed by Wigdahl,[1] to validate a planning model to develop an energy management plan in school districts. The instrument used a five-point Likert scale to determine the order of importance of each component of the model plan and a second five-point Likert scale to determine the operational feasibility of each component of the model plan.

The survey instrument used in the present study consisted of a planning model developed by the researcher after a review of the literature. Each component of the planning model was accompanied by a five-point Likert scale. Jury members could indicate their strong agreement, agreement, undecidedness, disagreement, or strong disagreement with each component of the model. An area was also provided for respondent comments.

The survey instrument was piloted by five staff members of the University of Nebraska-Lincoln with experience in planning for computer use in schools. They received the complete survey and were asked to complete it as instructed by the cover letter and included directions. This group was also asked to note the time it took to complete the survey and to suggest changes to improve the survey instrument. Their suggestions were incorporated

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[1]Leroy Wigdahl, "The Development of a Conceptual Planning Model for Use in the Development of an Energy Management Plan in School Districts," Diss. University of Nebraska-Lincoln, 1981, pp. 175-181.

into the final draft of the survey instrument (See Appendix C).

The survey was sent to the 29 potential participants on May 8, 1985. The 13 members of the International Society of Educational Planning were sent a personalized cover letter (See Appendix D-1), which recognized their membership in the ISEP and explained the purpose of the survey and the response procedure. The 16 members of the Association of Educational Data Systems received a similar letter (See Appendix D-2). Potential participants were requested to mail the completed survey in the stamped self-addressed envelope by May 17, 1985.

Potential participants were instructed to indicate their agreement or disagreement with each component of the planning model by circling the appropriate response on the corresponding five-point Likert scale. If jury members wished the composite results of the survey and the researcher's subsequent conceptual planning model mailed to them, they were instructed to check a box provided. Code numbers appeared adjacent to this box to provide the researcher a method to record returned surveys and to record those jurors requesting results.

Two weeks after the surveys were to have been mailed, the results were tabulated. Seventeen of the 29 surveys were completed and returned, a 59 percent response rate.

## Data Analysis

Returned surveys were scored by assigning a value of five (5) to strongly agree responses, a four (4) to agree responses, a three (3) to undecided responses, a two (2) to disagree responses, and a one (1) to strongly disagree responses. For each element of the planning model the mean, median, mode, and standard deviation of the assigned values were calculated. The mean was calculated by multiplying the number of responses in each category by the value given to that category. These products were summed and divided by the total number of responses for the item. These measures of central tendency are shown in tabular form in Chapter 4. Results of the validation process are also discussed for each major area of the planning model in Chapter 4.

# CHAPTER 4

# PLAN DEVELOPMENT AND VALIDATION

## Development of a Planning Model

The literature reviewed in Chapter 2 was the basis for the planning model presented in this chapter. A review of the available journal articles and reports allowed the researcher to distinguish seven components of plans school officials were using to integrate computers into school programs. Further review and analysis allowed the researcher to compile the following planning model.

## Planning Model

A. **A school district's Board of Education should appoint a computer planning task force to develop a sequence of activities to integrate computers into the complete school program. Membership on the task force should include:**

   1. Administrators.

   2. Teachers.

   3. Parents of school-age children.

   4. Patrons without school-age children.

B. **The computer planning task force should be provided adequate information and support to complete its assignment.**

   1. The school district's board of education should provide the computer planning task force with the funds to acquire the information and assistance necessary to formulate a plan for the use of computers.

      a. Funds should be made available for the task force to visit other school

districts.

b. Funds should be made available for the task force to hire a consultant to provide information and to facilitate the planning process.

2. The school district's board of education should assure the task force of its commitment to the use of computers and its willingness to adopt sound recommendations for computer use from the task force.

3. The school district's superintendent should demonstate support for the planning of computer use in the school district.

4. The school district's principals should actively support efforts to utilize computers.

5. All teachers should be solicited to support the implementation of computers.

C. **The computer planning task force should assess the computer needs of the school district. The computer planning task force should:**

1. Gather all information possible about computers and their use by students and staff.

2. Determine the computer expertise of the staff.

3. Determine the availability of computers and the extent of their use in the community, outside of the school.

4. Determine the computer expertise in the community that is available to the school.

5. Determine the computer expertise outside the district that is available to the school.

6. Determine the expectations of different community groups for the use of computers in their school.

a. Determine the expectations students have for their computer education.

b. Determine the expectations parents have for the computer education of their children.

c. Determine the level of computer training patrons without children think students should possess.

d. Determine the level of computer training business and industry officials expect high school graduates to possess.

D. **With information from the needs assessment, from the surveys of other districts, and the planning literature, the computer planning task force should develop long-range goals to guide the district.**

1. The computer planning task force should recommend a long-range plan, with time tables and tentative budgets to the school district's board of education.

2. The computer planning task force should recommend a short-range plan, with time lines and budgets to the board of education.

E. **The computer planning task force should recognize different aspects of the planning process that can be coordinated by committees with a membership representative of appropriate constituencies.**

1. The development of a complete scope and sequence for computer applications in each subject area of the instructional program should be assigned to a representative committee.

2. The recommendation of applications for the use of computers in the school's business offices should be coordinated by a committee with representative membership.

3. A process should be established to monitor the selection and purchase of all district software.

a. A software review committee should be appointed to aid in the selection and purchase of all district software.

b. The software review committee should be provided adequate funds to utilize independent evaluation agencies and computing consortiums to help with software selection and/or the training of committee members in the selection of software.

c. The software review committee should provide recommendations for the purchase of all district software.

d. The software review committee should aid the business office by recommending a budget for software acquisition.

4. A process should be established to monitor the selection and purchase of all district computer hardware.

a. A hardware review committee should be appointed to aid in the selection and purchase of all district computer hardware.

b. The hardware review committee should be provided the training necessary to become knowledgeable of computer hardware and its capabilities and future expandibility.

c. The hardware review committee should evaluate all requests for computer equipment based on the software applications it is to serve.

d. The hardware review committee should aid the district in developing a policy on standardization of equipment.

e. The hardware review committee should aid the business office by recommending budget amounts for hardware acquisition, peripheral acquisition, and maintenance and repair of computer hardware.

f. The hardware review committee should provide information on equipment location, cost of facilities renovation, and alternate means of acquiring

computing power.

F. The computer planning task force should include in its short-range and long-range plans, a sequence of teacher inservice to insure the computer literacy necessary to achieve the district's goals for computer education.

1. The computer planning task force should recommend the budget amounts necessary to fund the teacher inservice activities.

2. The school district officials should provide incentives for teachers to become computer literate and/or for assuming responsibilities in implementing computers into school programs.

G. The computer planning task force should be responsible for the continual evaluation of the planning process.

1. The board of education should require periodic task force and committee reports to assure that the plan is proceeding as scheduled.

a. Periodic reports should include an assessment of the success to which goals and objectives are being met.

b. The task force and committees should recommend adjustments to procedures as deemed necessary.

2. The computer planning task force should evaluate the success of the implementation plan and revise when necessary.

3. The task force should recommend to the board of education a new short-range plan annually.

4. The task force should recommend to the board of education a revised long-range plan annually.

## Model Validation

The validation of the planning model was conducted by

a jury of experts. The selection of the jury of experts and the administrative procedures used to collect the data to validate the model were outlined in Chapter 3.

## Presentation of Data

The summary of the responses made by the jury of experts on each component of the planning model is presented in Table 1. The mean response score for each component of the planning model is reported. The mean response score was computed by multiplying the number of responses in each interval by the value assigned to that interval, summing the products found, and dividing the sum by the total number of responses for that particular item. The intervals were assigned the following values: strongly agree (SA) = five (5), agree (A) = four (4), undecided (U) = three (3), disagree (D) = two (2), and strongly disagree (SD) = one (1).

Appointment of a Task Force. Jurors were very supportive of the task force concept, but they did not support all membership categories suggested in the planning model. Eighty-two percent of the jury members either agreed or strongly agreed that the board of education should appoint a task force to coordinate the process of integrating computers into a school's total program. The proposal that teachers, administrators, and parents of students be included on the planning task force received

Table 1

Frequency, Mean, Median, Mode, and Standard Deviation of Response Scores by Jury of Experts for Validation of the Planning Model

| Component Item | Frequency of Response SA (5) | A (4) | U (3) | D (2) | SD (1) | Mean | Median | Mode | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|
| A. Appoint a task force | 10 | 4 | 1 | 1 | 1 | 4.23 | 5 | 5 | 1.20 |
| 1. Administrators | 12 | 5 | | | | 4.70 | 5 | 5 | .47 |
| 2. Teachers | 16 | 1 | | | | 4.94 | 5 | 5 | .24 |
| 3. Parents (school-age children) | 5 | 9 | 1 | 2 | | 4.00 | 4 | 4 | .94 |
| 4. Patrons (without school-age children) | 2 | 3 | 7 | 4 | 1 | 3.06 | 3 | 3 | 1.08 |
| B. Provide task force support | 13 | 4 | | | | 4.76 | 5 | 5 | .44 |
| 1. Funds to acquire information | 13 | 3 | 1 | | | 4.71 | 5 | 5 | .59 |
| a. Funds to visit districts | 6 | 7 | 3 | | 1 | 4.00 | 4 | 4 | 1.06 |
| b. Funds to hire consultant | 5 | 6 | 4 | 1 | 1 | 3.76 | 4 | 4 | 1.15 |
| 2. Commitment from board | 12 | 4 | 1 | | | 4.65 | 5 | 5 | .61 |
| 3. Commitment from superintendent | 15 | 2 | | | | 4.88 | 5 | 5 | .33 |
| 4. Commitment from principals | 13 | 4 | | | | 4.76 | 5 | 5 | .44 |
| 5. Support from all teachers | 7 | 5 | 2 | 2 | 1 | 3.88 | 4 | 5 | 1.27 |
| C. Assess the school district | 13 | 4 | | | | 4.76 | 5 | 5 | .44 |
| 1. Students and staff | 8 | 8 | | 1 | | 4.35 | 4 | 4.5 | .79 |
| 2. Staff computer expertise | 10 | 7 | | | | 4.59 | 5 | 5 | .51 |
| 3. Computers in community | 5 | 10 | 1 | 1 | | 4.12 | 4 | 4 | .78 |
| 4. Expertise in community | 3 | 13 | 1 | | | 4.12 | 4 | 4 | .49 |
| 5. Expertise outside of district | 4 | 11 | 1 | 1 | | 4.06 | 4 | 4 | .75 |
| 6. Community expectations | 6 | 6 | 1 | 3 | 1 | 3.76 | 4 | 4.5 | 1.30 |
| a. Student expectations | 4 | 9 | 1 | 2 | 1 | 3.76 | 4 | 4 | 1.15 |
| b. Parent expectations | 4 | 9 | 1 | 2 | 1 | 3.76 | 4 | 4 | 1.15 |
| c. Patron expectations | | 5 | 8 | 2 | 2 | 2.94 | 3 | 3 | .97 |
| d. Business community expectations | 5 | 10 | 1 | 1 | | 4.12 | 4 | 4 | .78 |
| D. Develop long-range goals | 13 | 4 | | | | 4.76 | 5 | 5 | .44 |
| 1. Long-range plan | 11 | 5 | | 1 | | 4.53 | 5 | 5 | .80 |
| 2. Short-range plan | 12 | 5 | | | | 4.71 | 5 | 5 | .47 |
| E. Establish committee structure | 5 | 10 | 2 | | | 4.18 | 4 | 4 | .64 |
| 1. Instructional applications committee | 2 | 9 | 5 | | 1 | 3.65 | 4 | 4 | .93 |
| 2. Business applications committee | 4 | 7 | 1 | 1 | 4 | 3.35 | 4 | 4 | 1.54 |
| 3. Software selection process | 7 | 7 | 2 | 1 | | 4.18 | 4 | 4.5 | .88 |
| a. Appointment of committee | 6 | 6 | 2 | 3 | | 3.88 | 4 | 4.5 | 1.11 |
| b. Use of evaluation agencies | 1 | 9 | 3 | 3 | 1 | 3.35 | 4 | 4 | 1.06 |
| c. Recommend all purchases | 5 | 5 | 1 | 4 | 2 | 3.41 | 4 | 4.5 | 1.46 |
| d. Recommend budget for software | 7 | 3 | 2 | 3 | 2 | 3.59 | 4 | 5 | 1.50 |
| 4. Hardware committee | 12 | 5 | | | | 4.71 | 5 | 5 | .47 |
| a. Monitor selection | 7 | 7 | 2 | 1 | | 4.18 | 4 | 4.5 | .88 |
| b. Training for committee members | 6 | 5 | 2 | 4 | | 3.76 | 4 | 5 | 1.20 |
| c. Evaluate equipment request | 6 | 6 | 1 | 3 | 1 | 3.76 | 4 | 4.5 | 1.30 |
| d. Develop standardization policy | 8 | 6 | 2 | 1 | | 4.24 | 4 | 5 | .90 |
| e. Recommend hardware budget | 6 | 6 | 1 | 2 | 2 | 3.71 | 4 | 4.5 | 1.40 |
| f. Location, facilities cost, alternatives | 7 | 6 | 2 | | 2 | 3.94 | 4 | 5 | 1.30 |
| F. Provide teacher inservice | 15 | 1 | 1 | | | 4.82 | 5 | 5 | .53 |
| 1. Recommend inservice budget | 13 | 3 | | | 1 | 4.59 | 5 | 5 | 1.00 |
| 2. Teacher incentives | 10 | 3 | 2 | 2 | | 4.24 | 5 | 5 | 1.09 |
| G. Evaluate the planning process | 10 | 4 | 1 | | 2 | 4.18 | 5 | 5 | 1.33 |
| 1. Periodic reports | 11 | 6 | | | | 4.65 | 5 | 5 | .49 |
| a. Achievement of goals | 11 | 6 | | | | 4.65 | 5 | 5 | .49 |
| b. Recommend adjustments | 8 | 8 | 1 | | | 4.41 | 4 | 4.5 | .62 |
| 2. Evaluate success of plan | 8 | 7 | 2 | | | 4.35 | 4 | 5 | .70 |
| 3. Short-range plan annually | 8 | 6 | 3 | | | 4.29 | 4 | 5 | .77 |
| 4. Long-range plan annually | 8 | 6 | 2 | 1 | | 4.24 | 4 | 5 | .90 |

mean response scores of 4.94, 4.70, and 4.00, respectively. To include patrons without students on the task force received a mean response score of 3.06 and had positive support from only 29 percent of the jury members. Comments by the jurors indicated that all members included on the task force should have an interest in computer use. Jurors also indicated that community business people with computer expertise should be included on the task force.

Provide the Task Force Support. Jury members strongly agreed with the need to provide the task force moral and financial support, and agreed, to a lesser extent, with the use of district funds for some activities. Funds to aid the task force in acquiring information received a mean response score of 4.71, but having funds available to hire a consultant received the lowest mean response score in this section, 3.76. Comments of jurors indicated that outside consultant help should be sought only after a thorough search of local expertise had been conducted. The need for expressed commitment from the board, superintendent, principals, and all teachers was supported by the jurors. The need for the superintendent to demonstrate support received the highest mean response score, 4.88. Receiving support from all teachers received a score of 3.88.

Assess the School District. All assessment components

of the planning model, except the assessment of patron expectations, received the support of the jury. All jurors either agreed or strongly agreed that a district should assess its computer needs. Determining community, student, and parent expectations each received mean response scores of 3.76; however, determining patron expectations received a 2.94 mean response score. Only 29 percent of the jury members agreed that the expectations of patrons without children should be assessed.

Develop Goals. The jury strongly agreed with the need for the task force to develop long-range goals and short-range and long-range plans. Developing long range goals received a mean response score of 4.76. The component requiring the task force to present a short-range plan, with time lines and budgets, to the board of education received a 4.71 mean response score. A similar component requiring the task force to present a long-range plan to the board of education received a mean response score of 4.53. Juror comments suggested that the rate of change in the computer technology field makes long-range planning difficult and that long-range planning should be limited to three years, at most.

Establish a Committee Structure. The jury agreed with a committee structure to deal with the different aspects of the planning process. The establishment of a committee to

develop a complete scope and sequence for instructional computer applications received a mean response score of 3.65. The component that would establish a committee to recommend applications for the school's business office recorded one of the lowest mean response score in this section, a 3.35 score. As indicated by its standard deviation of 1.54, this component had a high level of disagreement among the jury members. Although 24 percent of the jurors strongly disagreed with a committee coordinating business applications, 65 percent of the jurors either agreed or strongly agreed with this component.

Jurors supported the appointment of a committee to aid in the selection and purchase of all district software, as indicated by this component's 3.88 mean response score. The component that would make funds available to use independent evaluation agencies or computer consortiums to help with the aquisition of software had a mean response score of 3.35. Although the 1.06 standard deviation indicated a wide range of responses, 59 percent of the jurors either agreed or strongly agreed with the component. Comments made by jurors stressed the need for flexibility at the building level in selecting software and the need to encourage teachers to explore their own ideas.

All jurors agreed or strongly agreed with establishing a committee to monitor the purchase of all district

computer hardware. This component received the highest mean response score in this section, with a score of 4.71. Four components of the hardware committee section had a wide range of response scores, as indicated by their standard deviations larger than 1.00, but in all of those components at least 65 percent of the respondents agreed or strongly agreed that those components should be included in the planning model. The proposal that hardware committee members should be provided training to become knowledgeable about computer hardware had a standard deviation of 1.20. Juror comments indicated that hardware committee members should be knowledgeable about computer hardware prior to appointment.

Provide Teacher Inservice. The jury strongly agreed with the staff inservice component of the plan and supported, to a lesser degree, recommending an inservice budget and providing teacher incentives to get them involved with computer applications. Fifteen of the 17 jury members strongly agreed with providing teachers with inservice to insure the computer skills necessary to achieve the district's goals. One juror labeled teacher inservice as the most important step of the entire process.

Evaluate the Process. All components of the evaluation section received support from the jury. Requiring periodic reports to assure that plans proceed on

schedule and assessing the achievement of goals and objectives received 4.65 scores. The component making evaluation of the process the responsibility of the task force received a mean response score of 4.18, the lowest in the evaluation section. Two strongly disagree responses varied considerably from the remainder of the responses for this component.

Summary of Findings. The jury of experts supported all components of the planning model developed from the literature except the two components that dealt with patrons without school-age children. The appointment of patrons without school-age children to the task force and the assessment of the expectations that patrons without school-age children had for the computer training of students received mean response scores of 3.06 and 2.94, respectively.

Two components of the section that would establish a committee structure were examined closely. The component that would establish a committee to coordinate the computer applications in the school's business office and the component that would make funds available to use independent evaluation agencies or computer consortiums to help with the acquisition of software had mean response scores of 3.35. Other indicators, however, demonstrated support from the jurors for these two components.

# CHAPTER 5

## Summary, Conclusions, and Recommendations

The results of this study allowed the researcher to develop a conceptual planning model to implement computer technology into the total program of a school. This chapter is divided into three sections. The purpose of this study and the procedures used are presented in the first section. The second section summarizes the findings and states the conclusions of the study. The conceptual planning model developed from the literature, refined through input from the jury, is presented as the culmination of the conclusions. Implications and recommendations of the study are presented in the third section.

## Summary of the Study

This study was conceived by the researcher to fill a void created by the introduction of microcomputers to K-12 education. School constituencies have realized the potential use of microcomputers in the world of tomorrow and are pressuring school officials to produce computer literate graduates. Without a process to plan for the use of microcomputers in schools, their introduction has been slow and poorly orchestrated. The conceptual planning model presented in this chapter is intended to fill the planning void created by the microcomputer. School

officials, regardless of their school's present computer status, can utilize the conceptual planning model to better plan for their district's use of computers.

## The Problem

The purpose of this study was to develop a conceptual planning model for the utilization of computer technology in K-12 school districts. Using this model, school officials can develop a planning process to implement administrative applications, as well as instructional applications, of computers in their school.

## The Research Procedure

The development of a conceptual planning model was divided into two parts: 1) the researcher's synthesis of the literature into a planning model, and 2) the validation of the planning model by a jury of experts.

Development of the Planning Model. To develop a planning model that could be refined by a jury of experts, the researcher conducted a review of literature that dealt with the introduction of computers into K-12 school districts. Since most computer applications of concern to this study deal with the microcomputer, literature published after January 1, 1980 was reviewed, a period that coincided with the early introduction of the microcomputer into schools.

A review of the literature indicated common elements of plans to introduce computers into schools. Further review and synthesis allowed the researcher to develop a planning model that contained many of the elements common to a majority of plans.

Validation of the Planning Model. To validate the planning model, 29 specialists in the area of educational planning and/or the use of computer data systems in education were contacted. These 29 specialists were the members of the board of directors of two international organizations, the International Society of Educational Planning and the Association of Educational Data Systems.

The survey used in this study allowed input from specialists from a wide geographic area in a quick, inexpensive manner. The survey instrument used to collect the data from the specialists consisted of the planning model developed from the literature and a five-point Likert scale, on which the respondents could indicate their agreement or disagreement with the component.

Seventeen of the 29 chosen specialists completed and returned surveys. These 17 specialists comprised the jury used to validate the planning model drafted from the literature by the researcher. Jury members had the opportunity to respond to each component of the planning model with a strongly agree, agree, undecided, disagree, or

strongly disagree response. The integral values of five through one were assigned to the five possible responses allowing the researcher to calculate a mean, median, mode, and standard deviation of the responses for each component of the planning model. These measures of central tendency allowed the researcher to gauge the level of agreement or disagreement the jury, as a group, had for each component of the planning model. The measures of central tendency and the comments made by the jurors are the basis for additions, deletions, or changes in the components of the researcher's planning model extracted from the literature.

## Conclusions

An analysis of the data provided in Chapter IV of this study yielded a conceptual planning model that includes many of the components of the planning model developed from the literature. This section includes a discussion of components validated by the jury, as well as an explanation of components that were changed, added, or deleted in the conceptual planning model by the researcher because of comments made by the jurors.

### Appoint a Task Force

The planning model developed from the literature was based on the concept of involving as many school constituencies as possible. The use of a task force to develop and coordinate the planning process to integrate

computers into schools was validated by the jury of experts. The jurors also validated the membership on the task force to include administrators, teachers, and parents of school-age children.

The jury, however, was undecided on the inclusion of patrons without school-age children and that component was excluded from the final model. The researcher added to the membership of the task force, people from the business community with expertise and interest in computer education because of the frequency that component was mentioned by the jurors on the survey item requesting other membership categories. The researcher also included the qualification that individuals appointed to the task force have expertise and/or interest in the use of computers in education because of the importance jury members placed on that ingredient through their comments.

Provide the Task Force Support

Support can be provided to the task force in several forms. Financial support to get information needed by the task force to develop a planning process in a knowledgeable and expedient fashion and moral support from different school constituencies during the planning process were deemed important by the jurors. The jurors validated all components of this phase of the planning process.

Concerns were expressed in the comment section of the

two components that received the lowest mean response scores. Jurors suggested that an outside consultant be hired only after a search of such expertise within the district was conducted. Several jurors indicated that getting a commitment from all teachers may be an unrealistic goal. Since these components received mean response scores close to 4.00, they remainded unchanged in the final model. Because of juror comments about the word "solicited" in the teacher component of this section, that component was changed to read, "All teachers should be expected to support the implementation of computer applications."

Assess the School District

In developing a plan for change, literature indicated that it is important to know the present status of a situation and what expectations different constituencies have for the future. The jurors validated components of the planning model that would assess computer use by students and staff, computer expertise of the staff, computer use in the community, computer expertise in the community, and computer expertise available to the school existing outside of the district. The jurors also validated the assessment of expectations of students, parents, and the business community. These components remained unchanged in the conceptual planning model.

The jurors were undecided on the component that would assess the expectations of patrons without children in school. That component was excluded from the final planning model.

Develop Goals

To plan effectively, targets must be set. A school district's goals for the use of computers must be clearly defined and serve as the destination of the planning process. Components developing long range goals and short-range and long-range plans were validated by the jury of experts. Jurors indicated concern, through their comments, that in the rapidly changing computer technology field, planning beyond three years would be difficult. That concern was also emphasized in the literature. The researcher, therefore, limited long range planning to three years in the final model.

Establish a Committee Structure

The planning model extracted from the literature employed a committee structure to involve different people in the planning process. It was suggested that committees be appointed to coordinate the scope and sequence of computer use in the K-12 instructional program, to recommend applications for use in the school's business offices, to develop a process to monitor selection of all district software, and to develop a process to monitor

selection of all district hardware.

Jurors validated the use of the committee structure to coordinate the planning process in all four areas. Although the component developing a committee to recommend computer applications for the business office scored a mean response of 3.35, 11 of the 17 jurors (65 percent) either strongly agreed or agreed with this component. Therefore, the component was retained in the final model. The use of evaluation agencies also scored a mean response of 3.35, but was retained in the final planning model because 10 of 17 (59 percent) either strongly agreed or agreed with the use of these outside agencies to help with software selection.

Ten of the 17 jurors (59 percent) either strongly agreed or agreed with the component requiring the software review committee to recommend the purchase of <u>all</u> software. Comments of jurors indicated a need for caution if committee members had sole responsibility for making recommendations for the purchase of software, thereby precluding suggestions from individual teachers. The researcher, therefore, reworded the component to read, "The software review committee should evaluate all recommendations for the purchase of software for the district." Juror comments also indicated that people appointed to the hardware review committee should have knowledge of computer hardware prior to their appointment.

That component was changed to include the qualifier that appointees have hardware knowledge. The component that deals with the training of the hardware review committee was appropriately edited to be consistent with the above change.

Provide Teacher Inservice

If teachers are to become actively involved in computer education, they must be computer literate. The jury validated all inservice components of the planning model.

Evaluate the Process

The development of an evaluation process to assess the progress of the plan to integrate computers into school programs was the responsibility of the computer planning task force. The evaluation process stressed the need for periodic reports to the board of education and a constant revision of the short and long range plans. All components of the evaluation phase of the planning process were validated by the jury of experts and appear unchanged in the final conceptual planning model.

Conceptual Planning Model

A. A school district's Board of Education should appoint a computer planning task force with the expertise and/or interest to develop a sequence of activities to integrate computers into the complete school program. Membership on the task force should include:

1. Administrators.

2. Teachers.

3. Parents of school-age children.

4. Community business people with computer expertise.

B. **The computer planning task force should be provided adequate information and support to complete their assignment.**

1. The school district's board of education should provide the computer planning task force with the funds to acquire the information and assistance necessary to formulate a plan for the use of computers.

   a. Funds should be made available for the task force to visit other school districts.

   b. Funds should be made available for the task force to hire a consultant to provide information and to facilitate the planning process.

2. The school district's board of education should assure the task force of its commitment to the use of computers and its willingness to adopt sound recommendations for computer use from the task force.

3. The school district's superintendent should demonstate support for the planning of computer use in the school district.

4. The school district's principals should actively support efforts to utilize computers.

5. All teachers should be expected to support the implementation of computer applications.

C. **The computer planning task force should assess the computer needs of the school district. The computer planning task force should:**

1. Gather all information possible about computers and their use by students and staff.

2. Determine the computer expertise of the staff.

3. Determine the availability of computers and the extent of their use in the community, outside of the school.

4. Determine the computer expertise in the community that is available to the school.

5. Determine the computer expertise outside the district that is available to the school.

6. Determine the expectations of different community groups for the use of computers in their school.

   a. Determine the expectations students have for their computer education.

   b. Determine the expectations parents have for the computer education of their children.

   c. Determine the level of computer training business and industry officials expect high school graduates to possess.

**D. With information from the needs assessment, from the surveys of other districts, and the planning literature, the computer planning task force should develop long-range goals to guide the district.**

1. The computer planning task force should recommend a long-range plan, not to exceed three years, with time tables and tentative budgets to the school district's board of education.

2. The computer planning task force should recommend a short-range plan, with time lines and budgets to the board of education.

**E. The computer planning task force should recognize different aspects of the planning process that can be coordinated by committees with a membership representative of appropriate constituencies.**

1. The development of a complete scope and sequence for computer applications in each subject area of the instructional program should be assigned to a representative committee.

2. The recommendation of applications for the use of computers in the school's business offices should be coordinated by a committee with representative

membership.

3. A process should be established to monitor the selection and purchase of all district software.

   a. A software review committee should be appointed to aid in the selection and purchase of all district software.

   b. The software review committee should be provided adequate funds to utilize independent evaluation agencies and computing consortiums to help with software selection and/or the training of committee members in the selection of software.

   c. The software review committee should evaluate all recommendations for the purchase of software for the district.

   d. The software review committee should aid the business office by recommending a budget for software acquisition.

4. A process should be established to monitor the selection and purchase of all district computer hardware.

   a. A hardware review committee should be appointed to aid in the selection and purchase of all district computer hardware. Appointees should have knowledge of computer hardware capabilities.

   b. The hardware review committee should be provided the training necessary to gain the additional knowledge of computer hardware and its capabilities and future expandibility needed to complete its task.

   c. The hardware review committee should evaluate all requests for computer equipment based on the software applications it is to serve.

   d. The hardware review committee should aid the district in developing a policy on standardization of equipment.

   e. The hardware review committee should aid the business office by recommending budget amounts for hardware acquisition, peripheral

acquisition, and maintenance and repair of computer hardware.

f. The hardware review committee should provide information on equipment location, cost of facilities renovation, and alternate means of acquiring computing power.

F. **The computer planning task force should include in its short-range and long-range plans, a sequence of teacher inservice to insure the computer literacy necessary to achieve the district's goals for computer education.**

1. The computer planning task force should recommend the budget amounts necessary to fund the teacher inservice activities.

2. The school district should provide incentives for teachers to become computer literate and/or for assuming responsibilities in implementing computers into school programs.

G. **The computer planning task force should be responsible for the continual evaluation of the planning process.**

1. The board of education should require periodic task force and committee reports to assure that the plan is proceeding as scheduled.

a. Periodic reports should include an assessment of the success to which goals and objectives are being met.

b. The task force and committees should recommend adjustments to procedures as deemed necessary.

2. The computer planning task force should evaluate the success of the implementation plan and revise when necessary.

3. The task force should recommend to the board of education a new one-year plan annually.

4. The task force should recommend to the board of education a revised three-year plan annually.

## Implications and Recommendations

The literature reviewed indicated that no comprehensive planning model exists to aid school districts in integrating computer technology into their complete program. As school officials develop more complete plans to utilize computer technology in their programs, reports of these plans will appear in the literature. A replication of this study at that time will allow the researcher to develop a more complete planning model from the literature.

It is recommended that the conceptual planning model developed in this study be field tested in several school districts of various sizes and that further study be conducted to determine the effectiveness of the conceptual planning model in those districts.

New developments in technology and higher levels of sophistication in the applications available to schools will require constant change and adaptations in the conceptual planning model. It is recommended that this study be replicated periodically.

The above implications and recommendations are intended to encourage school officials to realize the importance of planning for the use of technology in K-12 education and the need for change as new applications become available.

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# APPENDIX A

## Computer Use in Local Schools

## Computer Use in Local Schools

The computer as a tool has various uses in local schools. The type of computer or hardware, (micro, mini, or main frame) generally corresponds to the complexity, size, or volume of work required. The software requirements have to reflect what is to be done and at the same time be designed so compatibility exists between the software and the hardware. The type of computer use, or the various areas in which the computer may be used include: 1) administration, 2) instruction, 3) community-school relations, and 4) research. It is obvious that various categorizations could be used and it is also clear that the following list of computer uses is neither complete nor fixed. Any listing of computer uses is subject to change and expansion as the state of the technology advances and as educators become more knowledgeable and proficient in using computers.

1. Administration

   1.1 Finance
   - 1.1.1 Budgeting
   - 1.1.2 Payroll Management
   - 1.1.3 Purchasing
   - 1.1.4 Inventory
   - 1.1.5 Energy Control
   - 1.1.6 Student Activity Funds Accounting
   - 1.1.7 Student Fees
   - 1.1.8 Insurance

   1.2 Facilities
   - 1.2.1 Schedule/Use
   - 1.2.2 Food Services
   - 1.2.3 Supplies Inventory

- 1.2.4 Equipment Inventory
- 1.2.5 Maintenance Schedule
- 1.2.6 Security

1.3 Personnel
- 1.3.1 Records/Contracts
- 1.3.2 Payroll
- 1.3.3 Benefits

1.4 Library - Media
- 1.4.1 Acquisition/Inventory
- 1.4.2 Cataloging
- 1.4.3 Circulation Control
- 1.4.4 Subscriptions
- 1.4.5 Bibliographic Search (Network)
- 1.4.6 AV Equipment

1.5 Student Personnel
- 1.5.1 Census
- 1.5.2 Registration/Scheduling
- 1.5.3 Placement Records/Advisement
- 1.5.4 Health Records
- 1.5.5 Attendance Records
- 1.5.6 Follow-up Records
- 1.5.7 Student Activities
- 1.5.8 Career Counseling

1.6 Transportation
- 1.6.1 Equipment Inventory
- 1.6.2 Maintenance Records
- 1.6.3 Scheduling/Routing

1.7 Office Management
- 1.7.1 Word Processing/Printing
- 1.7.2 Record Keeping
- 1.7.3 Communication (Network/Electronic Mail)
- 1.7.4 Data Sources (Networks)

2. Instruction

2.1 Computer Education
- 2.1.1 Literacy Concepts
  - 2.1.1.1 Awareness
  - 2.1.1.2 Literacy
- 2.1.2 Computer Science

2.2 CMI
- 2.2.1 Diagnosis

2.2.2 Test Preparation
2.2.3 Tests Scoring & Analysis
2.2.4 Classroom Mgt./Grade BooK

2.3 CAI
2.3.1 Drill & Practice
2.3.2 Simulations
2.3.3 Tutorial
2.3.4 Games
2.3.5 Problem Solving

2.4 Software
2.4.1 Acquisition
2.4.2 Evaluation

3. Community School Relations

3.1 Community Adult Education

3.2 Community Services

3.3 Publications

4. Research

4.1 Pupil/Facility Trends

4.2 Pupil Evaluation Studies

4.3 Program Evaluation Studies

4.4 Research Retrieval (Networking)

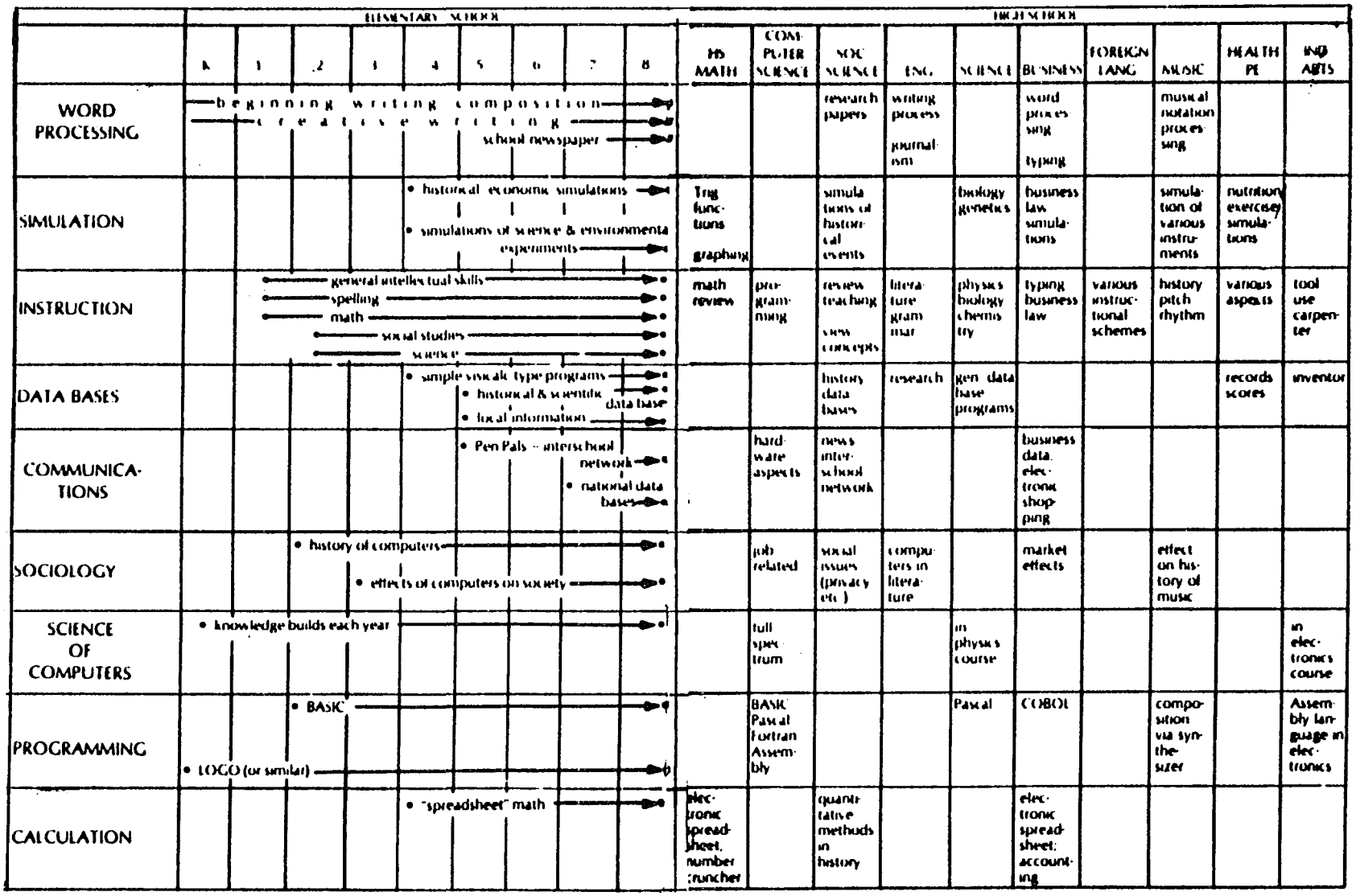
Reproduced from: Computer Analysis, Arlington Public School, Arlington, Nebraska 68002, September, 1984, by Dorothy J. Stevens and Ward Sybouts.

# APPENDIX B

## K-12 Computer Curriculum Matrix

K-12 COMPUTER CURRICULUM MATRIX

Reproduced from: Computer Considerations for Vermont Schools, ERIC ED 239 593, pp. 10-11.



# APPENDIX C

## Survey Instrument

Indicate your level of agreement with each component of the planning model to implement computers into schools by circling the appropriate response on the Likert scale to the right of each component. The responses are defined as strongly agree (SA), agree (A), undecided (U), disagree (D), and strongly disagree (SD). A space is available at the right margin for your comments.

NOTE TO JURY MEMBERS: This planning model is a synthesis of planning literature, journal articles, and reports of the implementation of computers into schools. This model reflects a philosophy of planning that would involve as many constituencies as possible, assuming that a greater amount of input, if coordinated, will produce a better product.

| Planning Model | Responses |
|---|---|
| A. **A school district's Board of Education shall appoint a computer planning task force to develop a sequence of activities to integrate computers into the complete school program. Membership on the task force shall include:** | SA A U D SD |
| 1. Administrators. | SA A U D SD |
| 2. Teachers. | SA A U D SD |
| 3. Parents of school age children. | SA A U D SD |
| 4. Patrons without school age children. | SA A U D SD |
| 5. Others - please list in the comment section. | SA A U D SD |
| B. **The computer planning task force shall be provided adequate information and support to complete their assignment.** | SA A U D SD |
| 1. The school district's board of education shall provide the computer planning task force with the funds to acquire the information and assistance necessary to formulate a plan for the use of computers. | SA A U D SD |

a. Funds shall be made available for the task force to visit other school districts. SA A U D SD

b. Funds shall be made available for the task force to hire a consultant to provide information and to facilitate the planning process. SA A U D SD

2. The school district's board of education must assure the task force of its commitment to the use of computers and its willingness to adopt sound recommendations for computer use from the task force. SA A U D SD

3. The school district's superintendent shall demonstate support for the planning of computer use in the school district. SA A U D SD

4. The school district's principals shall actively support efforts to utilize computers. SA A U D SD

5. All teachers shall be solicited to support the implementation of computers. SA A U D SD

C. The computer planning task force shall assess the computer needs of the school district. The computer planning task force shall: SA A U D SD

1. Gather all information possible about computers and their use by student and staff. SA A U D SD

2. Determine the computer expertise of the staff. SA A U D SD

3. Determine the availability of computers and the extent of their use in the community, outside of the school. SA A U D SD

4. Determine the computer expertise in the community that is available to the school. SA A U D SD

5. Determine the computer expertise outside the district that is available to the school. SA A U D SD

6. Determine the expectations of different community groups for the use of computers in their school. SA A U D SD

a. Determine the expectations students have for their computer education. SA A U D SD

b. Determine the expectations parents have for the computer education of their children. SA A U D SD

c. Determine the level of computer training patrons without children think students should possess. SA A U D SD

d. Determine the level of computer training business and industry officials expect high school graduates to possess. SA A U D SD

D. With information from the needs assessment, from the surveys of other districts, and the planning literature, the computer planning task force shall develop long range goals to guide the district. SA A U D SD

1. The computer planning task force should recommend a long range plan, with time tables and tentative budgets to the school district's board of education. SA A U D SD

2. The computer planning task force should recommend a short range plan, with time lines and budgets to the board of education. SA A U D SD

E. The computer planning task force shall recognize different aspects of the planning process that can be coordinated by committees with a membership representative of appropriate constituencies. SA A U D SD

1. The development of a complete scope and sequence for computer applications in each subject area of the instructional program shall be assigned to a representative committee. SA A U D SD

2. The recommendation of applications for the use of computers in the school's business offices shall be coordinated by a committee with representative membership. SA A U D SD

3. A process shall be established to monitor the selection and purchase of all district software. SA A U D SD

a. A software review committee shall be appointed to aid in the selection and purchase of all district software. SA A U D SD

b. The software review committee shall be provided adequate funds to utilize independent evaluation agencies and computing consortiums to help with software selection and/or the training of committee members in the selection of software. SA A U D SD

c. The software review committee shall provide recommendations for the purchase of all district software. SA A U D SD

d. The software review committee shall aid the business office by recommending a budget for software acquisition. SA A U D SD

4. A process shall be established to monitor the selection and purchase of all district computer hardware. SA A U D SD

a. A hardware review committee shall be appointed to aid in the selection and purchase of all district computer hardware. SA A U D SD

b. The hardware review committee shall be provided the training necessary to become knowledgeable of computer hardware and its capabilities and future expandibility. SA A U D SD

c. The hardware review committee shall evaluate all requests for computer equipment based on the software applications it is to serve. SA A U D SD

d. The hardware review committee shall aid the district in developing a policy on standardization of equipment. SA A U D SD

e. The hardware review committee shall aid the business office by recommending budget amounts for hardware acquisition, peripheral acquisition, and maintenance and repair of computer hardware. SA A U D SD

f. The hardware review committee shall provide information on equipment location, cost of facilities renovation, and alternate means of acquiring computing power. SA A U D SD

F. **The computer planning task force shall include in its short and long range plans, a sequence of teacher inservice to insure the computer literacy necessary to achieve the district's goals for computer education.** SA A U D SD

1. The computer planning task force shall recommend the budget amounts necessary to fund the teacher inservice activities. SA A U D SD

2. The school district shall provide incentives for teachers to become computer literate and/or for assuming responsibilities in implementing computer into school programs. SA A U D SD

G. **The computer planning task force is responsible for the continual evaluation of the planning process.** SA A U D SD

1. The board of education shall require periodic task force and committee reports to assure that the plan is proceeding as scheduled. SA A U D SD

   a. Periodic reports shall include an assessment of the success to which goals and objectives are being met. SA A U D SD

   b. The task force and committees shall recommend adjustments to procedures as deemed necessary. SA A U D SD

2. The computer planning task force shall evaluate the success of the implementation plan and revise when necessary. SA A U D SD

3. The task force shall recommend to the board of education a new one-year plan annually. SA A U D SD

4. The task force shall recommend to the board of education a revised three-year plan annually. SA A U D SD

If you would like to receive a copy of the aggregate results of this survey and the subsequent planning model to implement computers into schools, check the box to the right. ☐

Please mail the completed survey to Harlan Metschke, 202 Teachers College, University of Nebraska, Lincoln, NE 68588 by May 17, 1985.

APPENDIX D

Cover Letter to Potential Jury Members

D-1 Cover Letter to ISEP Members

D-2 Cover Letter to AEDS Members

University of Nebraska Lincoln

Department of Educational Administration
202 Teachers College
Lincoln, NE 68588-0473
Telephone: (402) 472-3726

May 8, 1985

Mr. Jury Member
Computer Public School
Apple Box
Computerland,USA

Dear Member:

As a school administrator I have experienced the difficulty of integrating computers into the total school program. Discussions with educators indicate that many schools are experiencing the same problem. Enclosed is a planning process to implement computers into schools that I have compiled from the literature. I have selected thirty individuals with expertise in the area of educational planning and/or the use of computer data systems in schools to serve as jury members to critique a planning model for the implementation of computers into schools. You have been selected because of your involvement in the International Society for Educational Planning.

I ask that you take 15 to 20 minutes of this week to complete the enclosed survey. Your responses and comments will allow me to develop a final model to effectively implement computers into schools. Your responses will be aggregated for statistical purposes; no individual responses will be reported. If you would like a copy of the results of this survey and the subsequent planning model to implement computers into schools, check the appropriate box at the end of the survey. Please return the survey in the enclosed envelope to Harlan Metschke, 202 Teachers College, University of Nebraska, Lincoln, NE 68588 by May 17, 1985.

Thank you for your time and interest in educational computing.

Harlan H. Metschke
Instructor
Department of Educational Administration
University of Nebraska-Lincoln

University of Nebraska Lincoln

Department of Educational Administration
202 Teachers College
Lincoln, NE 68588-0473
Telephone: (402) 472-3726

May 8, 1985

Mr. Jury Member
Computer Public School
Apple Box
Computerland,USA

Dear Member:

As a school administrator I have experienced the difficulty of integrating computers into the total school program. Discussions with educators indicate that many schools are experiencing the same problem. Enclosed is a planning process to implement computers into schools that I have compiled from the literature. I have selected thirty individuals with expertise in the area of educational planning and/or the use of computer data systems in schools to serve as jury members to critique a planning model for the implementation of computers into schools. You have been selected because of your involvement in the Association of Educational Data Systems.

I ask that you take 15 to 20 minutes of this week to complete the enclosed survey. Your responses and comments will allow me to develop a final model to effectively implement computers into schools. Your responses will be aggregated for statistical purposes; no individual responses will be reported. If you would like a copy of the results of this survey and the subsequent planning model to implement computers into schools, check the appropriate box at the end of the survey. Please return the survey in the enclosed envelope to Harlan Metschke, 202 Teachers College, University of Nebraska, Lincoln, NE 68588 by May 17, 1985.

Thank you for your time and interest in educational computing.

Harlan H. Metschke
Instructor
Department of Educational Administration
University of Nebraska-Lincoln

# APPENDIX E

Jury Members

## Jury Members

### AEDS Members

1. Mr. John W. Kelly
   Palm Beach Junior College
   4200 Congress Avenue
   Lake Worth, Florida 33461

2. Ms. C. Dianne Martin
   George Washington University
   Washington, D.C. 20052

3. Mr. Stephen M. Raucher
   Montgomery County Public School
   850 Hungerford Drive, Rm. 147
   Rockville, Maryland 20850

4. Mr. N. Michael Slater
   Kanawha County Board of Ed.
   Kanawha County School District
   Charleston, West Virginia 25311

5. Dr. Charles Speiker, Director
   Millard Public Schools
   1010 South 144th Street
   Omaha, Nebraska 68154

6. Dr. Dennis Spuck
   Dept. of Educational Leadership
   University of Houston
   4800 Calhoun Road
   Houston, Texas 77004

7. Ms. Sue Talley
   20525 Mariani
   M.S. 23 D.E.
   Cutertino, California 95014

8. Ms. Ann Tompkins
   San Diego Public School
   San Diego, California 92103

### ISEP Members

1. Mr. Gary Awkerman
   Charleston County School
   Charleston, SC 29403

2. Mr. A. J. Barone
   Metropolitan Sep. Sch. Bd.
   80 Sheppard Ave. East
   Willowdale, Ontario M2N6E8

3. Dr. Robert H. Beach
   Dept. of Educ. Admin.
   University of Alabama
   University, AL 35486

4. Dr. Robert N. Carlson
   Dept. of Education
   University of Vermont
   85 South Prospect Street
   Burlington, VT 05405

5. Dr. George J. Crawford
   Dept. of Administration
   University of Kansas
   Lawrence, Kansas 66045

6. Dr. Kenneth Ducote
   New Orleans Public Schools
   New Orleans, LA 70122

7. Dr. Don Halverson
   San Mateo County
   Office of Education
   Redwood City, CA

8. Dr. Lawrence Kiley, Supt.
   Union Springs Central
   27 N. Cayuga St.
   Union Springs, CA 13160

9. Mr. Lloyd MacDonald
   School District 35
   22259 48th Avenue
   Langley, British Columbia
   V3A3Z7