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Management of computer technology in the public schools : guidelines for the superintendent of schools.

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MANAGEMENT OF COMPUTER TECHNOLOGY IN THE PUBLIC SCHOOLS: GUIDELINES FOR THE SUPERINTENDENT OF SCHOOLS

A Dissertation Presented

By

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DEDICATION

I dedicate this dissertation to my wife, Merle, the person most responsible for this accomplishment. With her love, patience, support, and encouragement, I have been able to complete my graduate program and this dissertation. And to our daughters, Beth and Lisa, for their love and understanding.

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ABSTRACT

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MAY 1989

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The utilization of the microcomputer as an object of study, as a management tool, and, in particular as an instructional tool is a relatively recent phenomenon in the field of education. When first confronted with the prolific growth of microcomputers in his school district in the early 1980's this writer initiated a review of the literature for guidance in how to most effectively manage this phenomenon. He discovered a void. This dissertation has attempted to fill that void.

In this dissertation the reader will find a management plan based on: (1) this writer's experiences as an educator with technology in the public schools, (2) an extensive review of the literature, and finally, (3) a critique of the plan by educational practioners throughout the country. The author believes that this plan is based on the best information available to date.

The review of the literature in Chapter II of this paper contains an extensive amount of information that school leaders should understand when providing effective leadership for introducing an innovation into an organization. The topics reviewed include the change process, group development, the innovation itself, and also, the elements of effective leadership. These topics, in combination, provide the base of information required to successfully implement the management plan developed in this dissertation.

The focus of this paper has been the development of a system for the management of technology; it is not a study of teacher or student effectiveness as a result of utilizing technology. It is not a study of student achievement. It is a model for managing technology in the public schools. This plan can be adapted to the needs of a particular school system.

The essential components of the management plan for technology developed in this dissertation include: planning for organization and implementation, curriculum development, staff training, acquisition of hardware and software, provisions for support services, and program evaluation.

The author currently serves as the superintendent of schools for a school district of approximately 4000 students with a current student to computer ratio of 8 to 1.

DESCRIPTORS: technology, computer uses in education, superintendent, computers, educational change, educational technology, educational innovation, public schools, administrators, educational planning, development, long range planning, planning, implementation.

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CHAPTER I

INTRODUCTION

The discussion of microcomputers in education has become an arena in which one can learn a great deal about education itself (Cuffaro, 1984). In explaining, describing, hypothesizing, and questioning what computers can or will do in education, statements are are also made implicitly or explicitly, about the purpose of education, teaching, the content of curriculum, and the nature of the learner (Cuffaro). Everyone, from the most enthusiastic booster to the most fervent critic, agrees that the computer has brought, is bringing and will bring, profound changes in the shape of our society (Burnham, 1984). Schools have a responsibility to acknowledge the needs of an increasingly computerized society and prepare students to fulfill those needs as productive citizens (Bitter, & Camuse, 1984). Noble (1984) writes that the need for some form of computer literacy has come to be accepted as an essential condition of everyday life, now that the computer has insinuated itself into our jobs, our schools, and our homes. Recent polls indicate that some 90% of Americans believe that computer literacy is important enough to warrant its inclusion in the national educational curriculum (Menosky, 1984).

If education is not to become negligible, it must learn about and use computers (Miller, 1984). Moursand (1983) advises that a modern high quality education demands that students learn how to use computers as a general purpose aid to problem solving. Miller (1984) writes that no one disputes any more the need for making our children computer literate and able to cope with the rapid technological changes in our world.

Zakariaya (1984) suggests that as computer literacy and expertise become more and more essential in the workplace, it is clear that those who are in command of the technology will be more in command of their own lives in the future. Despite sharp disagreements among educators concerning the revolutionary potential of computer use in schools, there would seem to be few who would dispute the assertion that computers will affect schools in some fashion and to some degree (Coburn, Kelman, Roberts, Snyder, Watt, & Werner, 1982). Lee Hay, the 1983 Teacher of the Year, describes the computer as a tool that will do for the mind what machines did for the body; it will free us from unnecessary labor and amplify our limited human abilities (Hay, 1983). This thought is reinforced by Zamora (1983), who writes that the computer is not the goal, but the tool. The goal is the development of empowered and fully functioning citizens of an information-based society (Zamora).

According to the National Center for Education Statistics (1983), American education is being confronted by profound technological changes occurring in the larger society. The Center suggests that the potential computers hold for education is dramatic. Properly programmed computers can facilitate the teaching and learning process; computers can be used as tools in most subject areas, and computers can be used for administrative purposes. And finally, as an object of study, computers can prepare students for a wide variety of new careers in technology (National Center for Education Statistics). Taylor (1980) indicates that for the foreseeable future, computing will play an increasingly important role in human learning. However, no one yet knows exactly how great that role will eventually be, or precisely what form it will

take (Taylor). Taylor describes three potential uses of the computer in education: (1) to function as a "tutor" in some subjects, the computer must be programmed by experts in programming that subject; (2) to function as a "tool," the classroom computer needs only to have some useful capability programmed into it such as statistical analysis, super calculation, or word processing; and (3) to use the computer as "tutee" is to tutor the computer, for that the student or teacher doing the tutoring must learn to program, to talk to the computer in a language it understands (Taylor).

The computer is a jack-of-all trades. It can be a workbook page or a science laboratory, a teaching machine or personal tutor, a four-dimensional model or a fantasy world to be explored (Coburn, et al). It can compute grades for an entire class and generate reports that analyze the progress of every student in that class; it can teach and be taught (Coburn, et al).

One of the most important findings from the literature on technological methods of teaching has been the importance of the degree of student activity during learning (Jernstedt, 1983). Jernstedt (1983) has found significant improvements in the learning process with computer enhanced collaborative learning: the teacher who never has enough time to carry out all the teaching and interpersonal activities he or she needs to, gains major blocks of time; the student can double his or her efficiency during learning; the quality of what is learned is better; the attitudes of students are more positive towards what they are learning and the process is a fraction of the cost of more conventional methods.

With the computer students can pace themselves; they can linger over material that they need more time to absorb or they can speed through material that they quickly understand (Barger, 1983). Instead of being restricted to a scheduled time and place, as is the case with traditional classroom instruction, the student could use the computer assisted instruction at almost any hour and at any number of terminal locations (Barger).

In a meta-analysis study to integrate findings from 51 independent evaluations of computer based teaching in grades 6-12, Kulik and his associates (Kulik, Bangert, & Williams, 1983) found that: computer based teaching raised final examination scores by approximately .32 standard deviations,, or from the 50th to the 63rd percentiles; students who were taught on computers developed very positive attitudes toward the computer and also gave favorable ratings to the computer based courses they were taking; the computer reduced substantially the amount of time that students needed for learning; and the computer had an important positive effect on student attitudes.

Education Turnkey Systems Inc. (1984) developed a summary of 15 studies conducted over the last decade which have focused upon the effectiveness of computer-assisted instruction. They found that the current research findings clearly indicate that computer-assisted instruction can increase student achievement in certain areas when quality courseware is used, and when the programs are planned and implemented in an effective manner by school staff.

According to Laver (1980) the advantages claimed for computer-assisted instruction include the following: (1) each pupil receives individual

and private instruction; (2) pupils proceed at their own pace, and at times convenient to them; (3) the computer is extremely patient, ready to return a dozen times to the same point without irritation; (4) the pupil is not distracted by the troublesome problems of human interaction in the classroom; and (5) the course material and methods can be prepared by the best teachers of the subject and made available to all. On the other hand, Laver has identified the following limitations: (1) no machine can foresee and provide for every problem that will arise in use; (2) no machine can replace the inspiration given by a gifted teacher; (3) some people dislike machines, or lack confidence when using them; (4) the use of the computer is a seductive and insidious way of conditioning students to accept a technological culture; and (5) computer-assisted instruction greatly increases the opportunities for propagating a single point of view because the high cost of production favors the universal use of the 'one best' program.

Linelow (1983) indicates that computers will not "take over" the jobs of teachers and administrators; rather, computers will come to be seen as valuable teaching tools - indispensable aids that will greatly enhance each instructor's classroom effectiveness. Pitts (1983) describes the microcomputer's promise as an instructional, administrative, and managerial tool as impressive. Others say that the computer is like any other tool used in education; it is no more dehumanizing than a piece of chalk or a movie projector, or an index card file (Swartz, Shuller, & Chernow, 1984). Slesnick (1985) writes that computers are not teachers; they are tools that extend efficiency and ease drudgery. According to Dolan (1983)

it is important to remember that a computer is a tool, a type of instructional media; it cannot function independently of its user.

Unlike most other tools, computers extend the power of the intellect, rather than of the arm (Wold, 1983). While computers can be used for machine control, hence enhancing our physical capabilities, their greatest potential is in making it easier for us to think, to solve problems, to see relationships and patterns; they manipulate knowledge, or can be made to do so (Wold). Although computers are powerful tools, there are many things that they cannot do (Bitter, & Camuse, 1984). When they malfunction, a specialist called a computer technician, must be called in to remedy problems. Computers cannot make moral judgments, therefore, they can be used by unscrupulous humans to commit unlawful or immoral acts. The computer cannot act on its own without a set of written instructions and a human to control its mechanical operation (Bitter, & Camuse).

Computer-managed instruction (CMI) is a growing area of interest. It allows the functions of recording, assessing, marking, and reporting (Miller, 1984). It allows the teacher to structure, maintain control, and have immediate information about the daily progress of every individual child. The ability of the computer to free teachers from such duties as testing, correcting and keeping track ostensibly allows even more time for instruction and interrelationships (Miller).

Many educational institutions have been reacting to computer technology, rather than determining the course of computer use in the schools (Brosnan, 1983). The process is complex, and there are many decisions to be made before students can be instructed in the new

technologies - decisions about creating awareness and understanding among the faculty and the community, about curriculum planning and staff training, and about providing instruction (Mojkowski, 1983). According to Telem (1985) the application of new technology, especially a computer technology, and the conversion of an organization to use it as an endeavor requiring careful planning, background preparation, enlistment of professionals, changes in existing administrative and instructional work processes, retraining of employees, setting up a suitable physical plan, and various other professional activities. Telem (1985) feels that it is unfortunate for schools that their own organizational characteristics hinder full utilization of the computer's potential for their administrative and instructional systems.

Many school districts have moved into the arena of computer-assisted instruction without a clear understanding of how they will be used or fit into a curriculum. As a consequence, many computers are ending up as novelties in schools and are making little or no real contribution to the education of children. Burke (1985) writes that with proof of success all around them, there are still a few educators who hold that it is unnecessary, wasteful, and perhaps even harmful to put computers into schools. Their arguments are softened by other educators who believe that there is a potential in the use of computers, but it hasn't yet been determined (Burke). Burke also describes a third set of educators who have discovered a range of educationally valid uses of the computer (Burke).

Sloan (1984) suggests that American educators have made no concerted effort to ask at what level, for what purposes, and in what ways the

computer is educationally appropriate and inappropriate, and in what ways and to whom we can count on its being beneficial or harmful. Some of the most important questions are: How can the computer help in individualizing instruction? How might it change the teacher's role? How will computer-assisted instruction change the teacher-administrator relationship? Will it lead to impersonality and regimentation in the classroom? How can teachers play a part in planning and using computers for instructional purposes? (Suppes, 1980).

No one doubts that computers will play a rapidly increasing role in education (Dreyfus, & Dreyfus, 1984). And almost no one doubts that this will be a great boon for students and teachers. But this rush to computerize the classroom has bypassed the basic questions: In what areas can computers help and in what areas could the use of computers prove counterproductive? Just what is the proper place of computers in education (Dreyfus, & Dreyfus)? According to Miller (1984), in the last six years schools have become increasingly involved with computers, sometimes almost by accident, sometimes by actual design. Schools or districts which purchase microcomputers and simply dump them into the organization with half-hearted, seat of the pants efforts are asking for trouble (Grossnickle, & Laird, 1983).

The process of implementing instructional computing and computer literacy programs in a school system or college is quite different from developing programs in other areas (Bell, 1982). The reasons follow: instructional computing and computer literacy are cross disciplinary, consequently, many people must be involved at the beginning; strong ties must be established among data processing

personnel, administration, and classroom teachers; significant numbers of faculty members must be educated in instructional computing and computer literacy; and it is critical to avoid piecemeal planning (Bell). Bell (1982) writes that the key to a successful program is appropriate planning with sound goals and objectives for implementation, together with enlightened faculty development.

The Minnesota Educational Computing Consortium (MECC) 1983 has identified a number of key issues which districts may face as educational technology plans are developed: keyboarding; loss of key people; school board support/change in membership; licenser requirements/staffing resources.....shortfall; perceived lack of expertise; pockets of techno-phobia; commercial pressures; means versus ends; wait and see attitude; reaction of unions; configuration of equipment and facilities; high anxiety due to lack of proven models; graduation requirements; lack of consistency K-12; quick obsolescence; disparity of skill level among students; what if we're wrong/what if it doesn't work?; jobs in the future; inadequate support services; quick fix attitude/bandwagon; lack of adequate software; accountability to community/second guessers; pressure to cooperate with organizations outside of education; and computer programming.

Pepe (1984) reported, in early 1984, that 86.1% of this nation's 15,275 public school districts were computer users. This is a statistic that had doubled since the fall of 1981. By April of 1984, schools in the United States had approximately 350,000 computers available to students grades K-12; an average of about four computers per school. By the fall of 1984, this number had increased to 570,000 (Chion-Kenney,

1985). By 1987-1988 (Hayes, 1988) microcomputers were in 94.9% of the public schools (a total of 1,253,486 microcomputers). The rapid growth of microcomputers in education can be attributed to a number of factors: (1) a dramatic reduction in hardware costs relative to microcomputer speed and capacity over the past decade; (2) a grassroots movement which emerged during the late 1970's led by "computer buff" teachers; (3) external pressure on the schools by parents with home computers; and (4) school staff perceptions that microcomputers would increase their control of their work environment (Education Turnkey Systems).

Although the use of computers in the public schools is fast becoming almost universal, a survey by the National School Boards Association (Granite State Leader, 1984) indicates that the policies and procedures for using them are not keeping pace. Among the survey's findings were that although 96% of those surveyed indicated that they used microcomputers for instructional purposes, only 14% had established board policy for the selection of computer courseware or software.

A majority of schools in the United States (53%) had at least one microcomputer by January 1983 (Center For Social Organization of Schools, 1983). Only among elementary schools are there groups of schools where a majority do not yet have microcomputers. The typical junior high has three to four microcomputers (Median: 3.5) to serve a typical student population of about 700 students (Center for Social Organization of Schools). The Center reports that in contrast, high schools, particularly non-public schools, and combination junior-senior highs, have much more favorable student to computer ratios than do

junior highs (88:1 and 125:1). The focus is now shifting from whether a school owns a computer to how many computers should a school own (Hassett, 1984)? According to the most recent count there are about 92 students per machine in schools that own computers; almost everyone agrees that the ratio will be much lower in the future (Hassett). Cetron (1985), the futurist, projects that by the year 2000 computers will be available to 25% of the poorest school districts on a ratio of 1 per 8 students. In contrast, 25% of the most affluent school districts will have a ratio of 1 computer per 4 students.

By 1987-1988 almost half of all public schools had more than 10 computers (ERS Spectrum, 1988). The average micro-pupil ratio fell 74 percent between 1983-1984 and 1987-1988 from one microcomputer per 125 students to one micro per 32 students (ERS Spectrum, 1988).

The important issue now is the development of the process that schools should follow in managing computer technology in the most effective manner. All indicators suggest that the presence and influence of the computer in education will continue to grow (Bork, 1984). Everyone seems to agree that the potential of educational computing is very great indeed. But it is not at all clear just who is up to bearing the burden of fulfilling that potential (Komoski). Komoski writes that most parents are looking to the schools to make learning with computers an integral part of the educational process. Brosnan (1983) urges the development of a strategic management plan for computer use in the schools.

When strategic management is used to plan computer use in the schools, it can result in a program which is effective from both an

instructional and also a financial point of view. It allows districts to make decisions from within a framework of choice, rather than to make decisions as a reaction to every new piece of computer equipment as it enters the market (Brosnan). To manage the tremendous resources involved in district-wide computer usage, while not stifling the initiative of those who have brought the computer revolution to its present point, school district administrators need guidance for future decision making (Gray, 1984).

Dolan (1983) writes that computer education programs developed and implemented by a well-trained, professional staff may be a means to ensure that schools offer more individualized instruction of better quality, remedial assistance, enrichment programs for students with exceptional abilities, or advanced courses often not possible because of the constraints of personnel, time, or finances.

Changing an organization as complex as an elementary school, a public school district, or a university, is very difficult (Baldridge, & Deal, 1975). Administrators need more than personal skill and charisma; they need extensive knowledge of organizational behavior and of the process of organizational change (Baldridge, & Deal). These authors indicate that the literature on innovation provides little help for administrators who must confront innovation in its organizational context; most change management is largely based on intuition and seat-of-the-pants strategy (Baldridge, & Deal).

As with all changes in education, success or failure and the speed at which change occurs, depends on the expertise and attitudes of teachers (Stevens, 1980). Railsback (1983) reports that in the school

districts that he has studied, numerous new products or concepts have only limited success because the administrator did not implement the changes properly. With no prior discussion with the staff the superintendent announces that some innovation will be implemented; if the new ideas significantly affect teachers and principals, the stage is set for a failure. Top down reforms undertaken without the participation of those who must carry them out are doomed to failure (Graham, 1984). Enthusiastic and knowledgeable teachers are the key to successful use of computers in education (Stevens). Bitter (1985) indicates that a stumbling block threatening teachers in their quest to implement microcomputers in the classroom, however, is being posed by school and district administrators who can alienate teachers and condemn the computer to the same fate suffered by its media cousins: film, radio, television, and videotape media.

Lindelow (1983) proposes that the educational administrator interested in keeping the public schools "relevant" to the technological times would be advised to keep abreast of the rapid developments in computer technology and of projections for the future of computers in education. Lindelow writes that what the public schools need today are active and insightful managers of change who will help build the world of tomorrow instead of resisting its inevitable coming.

The review of the literature in Chapter II of this study will focus on the following:

A review of the literature on the role of the effective school leader.

A review of the literature on the innovations/change process in organizations.

A summary of the literature on the key factors to consider in the development of a comprehensive computer management program.

This project will attempt to formulate a blueprint for the school administrator in managing computer technology in the public schools. The writer will also incorporate his own experiences as a school manager in working with technology in the public schools.

CHAPTER II

A REVIEW OF THE LITERATURE

LEADERSHIP, CHANGE AND INNOVATION

A Review of the Literature on the Role of the Effective School Leader

The superintendent of schools is under continuous pressure to improve the school district's performance (Lewis, 1983). Knesevich (1984) describes the superintendency as a complex cluster of leadership, decision-making, planning, and change responsibilities that have a profound impact upon the operation and outputs of the educational organization. Education Research Service (1975) indicated that one ray of hope for helping central office administration cope with the increasingly complicated problems of running efficient school systems lies in their enlisting the assistance of building level administrators in the decision-making process. The pressure to improve has increased considerably as a result of a number of national reports on school reform. The superintendent must be an astute interpreter of these reports and focus on his/her district's efforts on those reforms that actually lead to improvements (Dianda, 1984).

In a national study conducted for the American Association for School Administrators, superintendents were asked what skill or information they felt they needed in order to continue to be effective (Cunningham, & Hentges, 1982). The results in order of importance were: general management skills, human relations skills, data management/ technology, financial skills, knowledge of social and education change

processes, other conflict resolution skills, political skills, and research skills.

This study has also revealed that administrators have a high regard for educational research. About half (49.5 percent) said that it is "usually useful" or "highly useful" (Cunningham, & Hentges). The authors found this reassuring when compared to survey results of the 1960's and 1970's indicating the irrelevancy of educational research.

One of the primary considerations for the superintendent should be the development of an effective planning process recognizing that even though planning facilitates and expedites the decision-making process, produces better informed and trained administrators, and improves the morale and effectiveness of the staff on the whole, the most prevalent problem associated with developing strategic and operational plans remains human-related (Lewis, 1983). Lewis writes that whenever an innovation is introduced into a school organization resistance may occur due to the fact that new methods and techniques have to be mastered and new approaches may disrupt the comfortable ways of doing things. Lewis (1983 indicates that an effective planning process should accomplish four things: improve decision-making process of planning unit administrators; enhance planning unit administrators' ability to function; affect all major key result areas of the school district positively; and, increase student learning and growth.

Research has shown that plans designed to address people's concerns as they emerge heighten the potential for success (Loucks-Horsley, & Hergert, 1985). This includes the way people are involved in decision-

making, the training and follow-up help they receive, and the expectations set and voiced by leadership personnel. The importance of clarifying expectations is also emphasized by Kanter (1983) who writes that people in organizations are constantly trying to figure out what their leaders really mean; which statements or plans can be easily ignored and which have command value. Deal (1982) makes the same point when he writes that if employees know what their company stands for, if they know what standards they are to uphold, then they are much more likely to make decisions that will support those standards.

There has been a substantial amount of information in the literature about the characteristics of the effective leader. Kanter (1983) writes that corporate entrepreneurs produce innovative achievement by working in collaborative participative fashion; by team building; by seeking input from others; by showing political sensitivity; and, by sharing rewards and recognition. Murphy (1983) identifies four areas that must be considered in the profile of an effective instructional leader: goals and production emphasis; power and decision-making; organization and coordination; and human relations.

Hoyle, English, & Steffy (1985) write that school leaders must have skills in: (1) designing, implementing, and evaluating school climate improvement programs; (2) human relations, organizational development and leadership; (3) collaborative goal setting and action planning; (4) organizational and personal planning and time management; (5) participatory management and the use of variations in staffing; (6) climate assessment methods; and, (7) group process, interpersonal communication, and motivation. Sergiovanni (1984) identified five

aspects of leadership: (1) technical- derived from sound management techniques; (2) human- derived from harnessing available social and interpersonal resources; (3) educational- derived from expert knowledge about matters of education and schooling; (4) symbolic- derived from focusing the attention of others on matters of importance to the school; and, (5) cultural- derived from building a unique school culture.

Hersey and Blanchard (1982) define leadership as the process of influencing the activities of an individual or a group in efforts toward goal attainment in a given situation. The authors stress that there is no best leadership style but that effective leaders adapt their leadership behavior to meet the needs of their followers and the particular environment (Hersey, & Blanchard).

There is considerable evidence (Fox, 1973) that a school is the shadow of its administrator. The author of this report argues that the school administrator is first and foremost a climate leader and that his/her key function is the improvement of the school's climate or learning environment. The importance of the role of the principal is reinforced by Dianda (1984) who indicates that the principal is the key factor in any school improvement effort. A 1973 report by Phi Delta Kappa (Fox, 1973) identifies the key factors for school climate improvement as: respect, trust, high morale, opportunities for input, continuous academic and social growth, cohesiveness, school renewal, and caring.

If the school is the basic unit for change and improvement then there will have to be a rethinking in the way that school systems are presently structured to a decentralization of specific functions with greater freedom and responsibility for budget, personal, and program

decisions at the school level (Robinson, 1985). An individual school should be encouraged to come up with its own plans based on its own analysis of that school's problems (Quimby, 1985). Quimby writes that for a school to become the key unit for educational change requires a substantially different stance at the district level than now exists. Boyer (1985) writes that we must find ways to give more participation and more empowerment to those who do the work. Boyer indicates that today's principals have limited time, few resources, and virtually no authority to make decisions. Marilyn Ferguson (1980) writes that the power of decentralization derives from the flow of new images, ideas, and energy to all parts of the body politic. The central office administration must understand and support school-based improvement (Wood, Freeland, & Szabo, 1985). This includes learning the roles necessary to support decision-making at the school level, rather than at the district level. When authority is delegated to the lowest possible level, an organization becomes really powerful (Shea, 1984).

The leadership of school principals can be strengthened by giving them more autonomy and authority (Dianda, 1984). Dianda asserts that their effectiveness is hampered by layers of administration red tape and that steps to rebuild the principal's leadership include giving each school more control over its budget and even providing discretionary money that they can use for ongoing school improvements. Dianda also writes that the individual school's efforts are enhanced when they can carry out their improvement within a common framework

provided by the central office. Although central direction and requirements are necessary, superintendents need to resist the temptation to issue decrees and to overly specify guidelines to schools (Dianda).

Cox (1983) feels that central office may well be the linchpins of school improvement efforts, linking together the external assistors and the building level administrators and teachers. Cox's research findings suggest that school improvement efforts need support at two levels: (1) assistance found on the "content" of the new practice, directed at the teachers who are implementing the innovation; and (2) assistance focused on the "context" of the new practice, aimed at securing the necessary approval, resources, facilities, and personnel to ensure continuation and institutionalization of the innovation. This support would require the collaboration of central office staff, the principal, and external resources.

Deal (1982) predicts that rapid technological change will cause a breakdown in the large traditional, hierarchical organizations that have dominated in the past. He feels that this dismantling will result in highly decentralized organizations in which the work of the corporation will be done in small, autonomous units linked to the mega-corporation by new telecommunications and computer technologies.

Bureaucracy has long been accurately criticized for its lack of both external and internal responsiveness (Stein, & Kanter, 1980). In their description of the parallel organization they emphasize the need to design organizations that are responsive to both their environments and to their people. The parallel organization is an attempt to institutionalize a set of externally and internally responsive, participatory,

problem-solving structures alongside the conventional line organization that carries out routine tasks (Stein, & Kanter). The main task of the parallel organization is the continued reexamination of routines; exploration of new options; and development of new tools, procedures, and approaches.

An important element of the school-based improvement model is the extent to which the administrator sets up decision-making structures that provide for staff input. Drucker (1984) writes that the first managerial skill is the making of effective decisions. He defines decision-making as a judgment; as choice among alternatives. Drucker feels that the effective decision-maker encourages opinions. According to Simon (1960) decision-making comprises three principal phases: finding occasions for making a decision; finding possible courses of action; and choosing among courses of action. Hoyle (Hoyle, English, & Steffy) write that school leaders must know the goals of their schools and which decisions they wish to share.

Cunningham (1982) views decision-making as a flow from more general long-range decisions to specific short-range ones. He regards decision-making as the most dramatic stage of problem-solving; the stage where we commit ourselves to a specific course of action. Probably the best known feature of the Japanese organizations is their participative approach to decision-making (Ouchi, 1981). When an important decision needs to be made in a Japanese organization, everyone who will feel its impact is involved in making it (Ouchi). Quality of participation really determines whether any particular organizational life or any particular human democratic process will succeed or fail (Lippitt, 1965).

There is a strong likelihood that participative methods will be used when an organization's prime movers feel that the impetus for change is internally driven, based on choice and responsiveness, rather than externally imposed, based on coercion and resistance (Kanter, 1983).

Teachers can be a powerful force for school change when they are allowed to participate in rational problem-solving and responsible widely shared decision-making (Sparks, Nowakowski, Hall, Alec, & Imrick, 1985). Sharman (1984) advises that the quality of the decision-making process determines the ultimate success of the organization.

Boyer (1985) expresses the concern that in the search for school improvement, the emphasis will be on regulation rather than on renewal. He feels that it is ironic that while the nation's industries and businesses are encouraging more responsible involvement of the workers, the public sector seems to have it just the other way around. Too many states are trying to fix education from the top, and, in the process, imposing more bureaucracy and control (Boyer, 1985). He feels that as more authority shifts away from the local school, we may be shaping unwittingly a bureaucratic education model that leaves teachers and principals more accountable, but less empowered.

In their study of organizations, both in the private and public sectors, Peters and Austin (1985) identified two primary ways to create and sustain superior performance over the long haul. First, take exceptional care of your customers (read "students") via superior service and superior quality. Second, constantly innovate (Peters, & Austin). The authors point out that both of these factors are built on a bedrock of listening, trust, and respect for the dignity and

creative potential of each person in the organization. Shea (1984) regards trust as the miracle ingredient in organizational life- a lubricant that reduces friction, a bonding agent that glues together disparate parts, a catalyst that facilitates action.

Peters and Austin believe that the words "management" and "managing" should be discarded. They write that management with its attendant images, connotes controlling and arranging, and demeaning and reducing; while "leadership" connotes unleasing energy, building, freeing, and growing (Peters, & Austin). Odiorne (1961) described the difference between management and administration. The manager makes things happen by whatever means are required, while the administrator follows certain procedures mechanically (Odiorne).

Naisbitt (1982) wrote that American companies are taking another look at the value of worker participation, evidenced by the recent boom in Japanese style quality circles; groups of people working together who meet regularly to discuss work-related problems and solutions and other similar work teams, including quality-of-work-life (QWL) groups. He indicates that decentralization of authority and responsibility is occurring in organizations throughout this country. This trend is providing employees greater opportunity to participate in the decision-making process in their organizations. People whose lives are affected by a decision must be part of the process of arriving at that decision (Naisbitt). According to Zangwill (1976) group behavior has suggested an answer to the boredom that many persons experience at work. The solution is job enrichment, a process in which the employee is given

flexibility and control over his/her job, permitting greater participation, decision-making authority and involvement; all positive reinforcers.

Kurt Lewin, Ronald Lippitt and Ralph White's work in the 1930's and 1940's established the study of group process as related to planning, decision-making and leadership in general (Cunningham, 1982). Cunningham wrote that it was the study by French & Lewin (1940) that concluded that democratic values of participation have a positive impact in changing basic beliefs, making individuals more responsive to technical change, increasing productivity, and contributing to more positive employee attitudes.

Shaw (1971) defined a group as two or more persons who are interacting with one another in such a manner that each person influences and is influenced by each other person. Tubbs (1984) defines small group interaction as the process by which three or more members of a group exchange verbal and nonverbal messages in an attempt to influence one another. Group dynamics refers to the complex forces that are acting upon every group throughout its existence which cause it to behave the way it does (Knowles, & Knowles, 1959). These authors write that a group always has dynamic aspects: it is always moving, doing something, changing, becoming, interacting, and reacting.

The importance of groups in an organization is best exemplified by the awareness that a group can come up with a richer set of alternative solutions than an individual, and these alternatives can be subjected, as a rule, to sounder group judgment (Glaser, Abelson, & Garrison, 1933). Likert & Lippitt (1953) made this same observation in their studies of groups when they wrote that through group discussions a

broader perspective can be derived because the group brings to the data, experience that is richer and more varied that that of any individual. This is further reinforced by Cohen (1984) who concludes that a group is more than the sum of the individual members.

The challenge to school management personnel is to devise the system for drawing upon the power of groups to improve the total operations of the school. Building-wide assimilation of attitudes, goals, policies, and procedures depend on the exercise of leadership authority by school administrators (Block, 1983). Block describes their actions as crucial to school success; they initiated programs, set policy, obtained and allocated resources, influenced subordinates and provided motivation and support for school improvement. There is substantial evidence that administrators in effective schools set up decision-making structures that provided for staff input (Block).

Shea (1984) wrote that never before have we seen such a pervasive interest in participative management, quality circles, union-management committees, work teams, quality of worklife programs, and the like. He observed that each of these innovations draws on the power of mutually beneficial interaction. Shea indicates that organizational, as well as personal success, depends on effective interactions among people.

How then can school management personnel provide the necessary leadership for effective group interaction and development?

The first step would be to develop an understanding of the structure of group development. Tubbs (1984) in his textbook on small group interaction outlined the four group phases that seemed to him to be representative (primarily the work of Tuckman) in the literature:

1. Phase one (forming) seems to be a period in which group members simply try to break the ice and begin to find out enough about one another to have some common basis for functioning. This is the period of orientation, inclusion, or group formation.

2. Phase two (storming) is frequently characterized by conflict of some kind or another. In this phase the group begins to thrash out decisions for procedures as well for determining the solution to the group's task.

3. Phase three (norming) involves a resolution of the conflict experienced in the previous phase. Cohesiveness develops and the group settles in to working more comfortably as a unit.

4. Phase four (performing) is the phase of maximum productivity and consensus.

According to Cohen (1984) there are five recognizable stages in the development of work teams: membership, subgrouping, confrontation, individual differentiation, and shared responsibility. He indicates that it takes a lot of time to build a shared responsibility team. Hanson (1981) describes the group development process as including the stages of unfreezing the participants' typical attitudes and behaviors; the discovery of new and more effective ways (concepts and skills) of coping with their present situation; and refreezing which is the process by which the new attitudes and behaviors acquired during the changing phase are integrated into the participants' ongoing relationships. Hanson's theory was based on the original work of Kurt Lewin. Hanson writes that the group is the basic social unit and group living is the predominant mode of existence.

Another variation of the group development process is also set forth by Hanson (1981). The beginning of a group's life is called the dependency stage in which individual members must resolve a number of interpersonal issues. In the second stage interpersonal conflict arises as a result of the group interaction as the group organizes itself with regard to task function. The next stage is referred to as the cohesion phase as people experience a sense of belonging to a group and a feeling of catharsis as a result of having resolved their interpersonal conflicts. The final stage is referred to as the independence phase in which members can work individually, in any subgroup, or as a total group.

The initial event in group interaction is the establishment of a relationship between two or more persons (Shaw, 1971). She also describes this event as group formation indicating, however, that it should be clear that the formation of a group is a continuous process. Group achievement is the consequence of performances, interactions, and expectations mediated through group structure and operations (Shaw). Shaw writes that the dimensions of group achievement are productivity, morale, and integration.

According to Kanter (1983), people initially bring different needs and interests into any kind of group from their location outside it, but eventually, when the group begins to jell as a cooperative entity, the representatives sometimes forget their external affiliation in favor of team identification - sometimes to the detriment of the constituency supposedly being served by the participation of its representative.

The next essential skill that school management personnel should have is an understanding of how to select the appropriate leadership style based on the nature and needs of the group. This would also include an awareness of the various types of groups that exist such as primary groups which include one's family and close friends; casual and social groups which include neighborhood groups, fraternities, golf partners et al; educational groups which get together for the primary purpose of study or instruction; work groups; encounter groups; and problem-solving groups (Tubbs, 1984). In his studies of group dynamics Lewin concluded that it was futile to try to change any worker from one behavior pattern to another unless the entire group to which the individual belongs is included in the change (Marrow, 1977).

The pioneering study of leadership styles with groups was conducted by Lewin and his associates (Lippitt & White) in which they investigated three types of styles (Shaw, 1971):

1. autocratic- the leader determined all policy for the group, and dictated techniques and actions.

2. democratic- the leader allowed the group to determine matters of policy.

3. laissez faire- the leader was essentially a non-participant in group activities.

Hare (1976) summarized the experiments of Lewin contrasting the three groups atmospheres. Members of the authoritarian groups showed more dependency on the leader and more hostile and apathetic behavior between members. In the laissez faire group there was little dependency on the leader, but greater irritability and aggressiveness among members

and dissatisfaction with the task. The democratic group showed less dependency on the leader, more friendliness, and satisfaction with the activities of the group. The autocratic groups surpassed the others, initially, in quantity of output, but the products of the democratic groups were judged to be of the best quality (Hare). He indicated that studies have demonstrated that when groups which had previously been led by authoritarian leaders were shifted to a freer democratic or laissez faire group atmosphere, they showed a great burst of horseplay at first; an indication of unexpressed group tension.

Because the democratic process implies participation, involvement, and commitment, each individual needs to participate in decisions that affect group goals, feel responsibility to an ownership of the group's task, experience a sense of contribution, and be acknowledged for that contribution (Hanson, 1981). People support what they help to create.

The role of the leader was recognized by Lewin as vital to the process of introducing changes needed to improve group life (Marrow, 1977). Lewin believed that the motivation and morale of each group was apparently proportional to the degree that it shared in the decision-making. Lewin was a pioneer in the investigations of the relationship between leadership, group atmosphere, and consequent group accomplishment (Marrow).

Ouchi (1981) describes the need for skill in recognizing patterns of interaction in decision-making and problem-solving groups, such as: learning to see when a group moves too quickly to a solution in order to avoid discussing the real problem; learning to observe how some

members interface in subtle ways in an open discussion; and learning to note when the group drifts off course.

The leader of a group must be able to ensure that the group maintains direction, moves expediently toward the development of plans, and provide opportunities for all members to participate and contribute (Cunningham, 1982). Cooperation in seeking and achieving change grows out of honest participation with full recognition and appreciation of the important ideas that the many kinds of people involved can contribute (Likert, & Lippitt, 1953).

Miller (1979) writes that not only must the leader fit the context and needs of the organization, he or she must be flexible in style and technique in response to the needs of the group. Managers must look at the personality of the group to determine what different managerial styles are required (Miller). The primary goal is to change patterns of relationships between people and groups or between a group and the organization so that more effective problem-solving and greater production effort can occur throughout the entire organization (Blake, & Mouton, 1965).

As a group works together it often develops close bonds which mean that people cannot always be open and honest with one another for fear of hurting someone or because of norms developed in the group (Kanter, 1983). Thus, there are some issues for which managers need to step in and take responsibility. Kanter writes that there are some issues on which it is a relief to have a higher status authority simply take over and decide; it would be too difficult or too emotionally pressuring for the group itself (Kanter). Once a norm is established, members do not

deviate easily from it, and some members may conform even against their better judgment (Tannenbaum, 1970). According to Tannenbaum, a general basis for the attractiveness of the group is the satisfaction that people derive from their social relations in it.

The importance of understanding the impact of group dynamics on organizational effectiveness is further highlighted by the following review of the literature:

1. Skills in group process are vital in order to ensure that each member of a group feels free to contribute and is valued as a person of worth (Hoyle, English, & Steffy).

2. Increasingly complex problems of interdependence, welfare, education, leadership, and decision-making are being created as a result of the rapid rate of technological development (Lippitt, & Lippitt, 1978). There is much greater need for persons and groups to collaborate, to ask for and give help and support to each other (Lippitt, & Lippitt).

3. As the group develops in trust and maturity, members will be willing to examine openly how they are working together (Cohen, & Bradford, 1984).

4. It is the middle and upper-middle managers of contemporary organizations who hold the key to high performance (Cohen, & Bradford).

5. Teaching is improved when teachers share and evaluate new ideas and practices with their colleagues (Chesler, Schmuck, & Lippitt, 1963).

6. Present research on staff development and inservice programs emphasize collegiality- whether it is represented by teachers coaching each other in methods or by teachers, administrators, and researchers working together to affect school improvement (DeBevoise, 1982).

7. The study of group dynamics has begun to produce some generalizations about the factors which affect the value of groups as instruments of change: (a) each person tends to feel committed to a decision or goal to the extent that they have participated in determining it; (b) every group is able to improve its ability to operate as a group to the extent that it consciously examines its processes and their consequences and experiments with improved processes (Knowles, 1978).

8. Most organized learning takes place in groups- largely because of the greater efficiency of operation afforded by dealing with people in groups and because of the richer resources and motivations for learning provided by a group (Knowles, 1980).

9. Most managers spend fifty to ninety percent of their working time in some form of group activity (Carew, Parisi-Carew, & Blanchard, 1984).

10. One of the core responsibilities of the curriculum change agent is to develop the support system which must surround and help every teacher; support through colleagues, administrators, and parents (Lippit, 1966). Lippitt writes that the support system is crucial if the teacher is to be innovative, creative, and willing to take risks in the development of new curricula.

11. A participative change cycle is implemented when new knowledge is made available to the individual or group (Hersey, & Blanchard). It is hoped that the group will accept the data and will develop a positive attitude and commitment in the direction of the desired change.

12. Good teachers who work with other good teachers become even

better, and their skill acquisition and teaching rewards prompt the further development of collaborative bonds with teaching colleagues (Rosenholtz, & Kyle, 1985).

13. Research suggests that the most effective schools, where student learning gains are greatest, do not isolate teachers but instead encourage professional dialogue and collaboration (Rosenholtz, 1985).

14. Whether called "task forces," "quality circles," "problem-solving groups" or "shared responsibility teams" such vehicles for greater participation at all levels are an important part of an innovating company (Kanter, 1983).

15. Leadership, the existence of people with power to mobilize others and to set constraints, is an important ingredient in making participation work (Kanter).

16. Change is more permanent if the innovation decision is participating rather than authoritarian; the teachers themselves decide that the change is advantageous and necessary (Winner, 1983).

17. People who are part of the team who "own" the company and "own" their job, regularly perform a thousand percent better than the rest (Peters, & Austin, 1985).

Which leadership style a person should use with individuals or groups depends on the maturity level of the people the leader is attempting to influence (Hersey, & Blanchard). Maturity is defined as the ability and willingness of people to take responsibility for directing their own behavior; it is a variable that should be considered only in relation to a specific task to be performed (Hersey, & Blanchard). The authors describe the four basic leadership styles as

telling, selling, participating, and delegating. There is not best leadership style, but rather, effective leaders adapt their behavior to meet the needs of their followers and the particular environment.

There has been a considerable amount of research conducted on what constitutes an effective school. The research has been focused on determining those characteristics of schools that make a difference in improved student achievement and development. Research has indicated that the local school unit, rather than the district as a whole, is the unit where improvement efforts should start (Cromer, 1984). Dianda (1984) describes the school principal as the key factor in school improvement efforts; therefore, they must be given more autonomy and authority. Quimby (1985) indicates that improvement programs have been tended to be district wide; they are usually an effort by all schools in a district to attack the same problem at once.

Block (1983) writes that the focus in effective schools was on instruction with administrators, teachers, students, and parents working together to achieve objectives. Effective schools set clear goals, devised specific plans to reach the goals, directed school resources toward achieving the goals, and created a school environment supporting goal attainment. School improvement requires collaboration and the ability to work effectively with groups. According to Saphier & King (1985), the culture of the school is the foundation for school improvement. They describe the cultural norms that affect school improvement as: collegiality; experimentation; high expectations; trust and confidence; tangible support; reaching out to the knowledge bases; appreciation and recognition; caring, celebration, and humor; involvement in

decision-making; protection of what's important; traditions; and honest, open communication.

School leaders must have skills in designing, implementing, and evaluating school climate improvement programs (Hoyle, English, & Steffy, 1985). These skills would include: human relations, organizational development, and leadership skills; collaborative goal setting and action planning; organizational and personal planning and time management skills; skills in participatory management and the use of variations in staffing; climate assessment methods and skills; skills in improving the quality of relationships among staff and students to enhance learning; multicultural and ethnic understanding; and group process, interpersonal communication, and motivation skills.

Cetron (1985) projects that in the schools of the future many teachers will operate in teaching teams. These teams will be able to use frequently updated information on their students to design individual education plans. Teachers will be assigned students based on the kind of teaching they do best. Students will not be assigned by grade level, but by the developmental level they have reached in each subject area (Cetron). The implications, however, which are more specifically related to the purposes of this paper, are that one of the important skills for the future teacher will be the ability to interact with peers in planning for the instruction of students, as opposed to the current isolated setting in which teachers work. Knowledge of group process will become a vital skill for the teacher.

The trend toward decentralization will require further changes in the educational structure in the years ahead (Cromer, 1984). Cromer

writes that as school leadership focuses more on principals, classroom teachers will be viewed increasingly as instructional managers and planners. These changes will require superintendents to assume more responsibility as community brokers, goal formulators, resource providers, and evaluators of results (Cromer). Cromer suggests that the central office will become the goal setting and planning arm for the district's schools; serving increasingly as the manager of change, the most constant staple of the information society. Cromer believes that positive change is likely to result in those schools where educators: (1) provide a vision of the direction for future change and an ongoing rationale of the need for change; (2) develop a data base and understanding of needed changes; (3) involve a variety of individuals and groups in identifying problems and solutions which can lead to the desired outcomes; (4) provide staff with knowledge and skills necessary for the implementation of changes; (5) procure the financial, physical, and human resources necessary for change; and (6) establish a monitoring system for identifying and reinforcing progress (Cromer).

According to Havelock (1973), the executive leadership of an organization has two responsibilities: one is the maintenance of the system the way it is; and the other is changing the system so that it performs better. The administrator should have at least six goals in mind: (1) the administrator should know about the "process of change," how it takes place and the attitudes, values, and barriers that usually act as barriers or facilitators; (2) The administrator should know who in the system has the resources relevant to various change efforts; (3) the administrator needs to maintain a high level of awareness of

new practices potentially worthy of adoption by the system; (4) the change-oriented administrator works to achieve a certain degree of "dither" in the system, he/she builds a staff with a diversity of views and approaches, and encourages dialogue among them; (5) the administrator-change agent should always hold a total system view of change and its effects; and (6) the administrator-change agent needs to be working constantly to build the internal self-renewal capability of the staff and of the organization as a whole (Havelock).

When individuals feel that they can make a difference and that they can improve the society in which they are living through their participation in an organization, then it is much more likely that they will bring vigor and enthusiasm to their tasks and that the results of their work will be mutually reinforcing (Bennis, & Nanus, 1985). Bennis and Nanus describe the new leader as one who commits people to action, who converts followers into leaders, and who may convert leaders into agents of change. They suggest that historically leaders have controlled rather than organized, administered repression rather than expression, and held their followers in arrestment rather than in evolution. Leadership is what gives an organization its vision and its ability to translate that vision into reality (Bennis, & Nanus).

The review of the literature clearly demonstrates the need for visionary and knowledgeable leadership in organizations. Skillful leadership is required; leadership which is described as unleashing energy, building, freeing and growing (Peters, & Austin). The public schools need effective leaders for the information age. With a vision,

the leader provides the all important bridge from the present to the future of the organization (Bennis, & Nanus).

A Review of the Literature on Innovations/Change Process in Organizations

Paul Valery', the French poet, once said that the future isn't what it used to be (Diebold, 1985). By this he meant that it is no longer possible to project a reasonably accurate scenario of the future from an analysis of the present. The new information technologies are having a profound effect on the ability of organizations to plan for the future in an orderly manner. Diebold writes that there is nothing in thousands of years of human history to prepare ourselves for the incredible changes in our lives and our lifestyles that computer and communication technology will generate. Computers seem to be everywhere today, performing every conceivable function, inaugurating the most thorough-going change in society in several generations (McClellan, 1984).

We live in an era of constant, rapid, and radical change, when tomorrow may bring a complete alteration in the way people work and play (ERS School Research Forum, 1983). The ERS report states that educators carry an especially heavy burden because they must determine what to teach the nation's children to ready them for work and leisure in an age of microchips, computers, robots, advanced telecommunication systems, and other complex technology. Naisbitt (1982) indicates that innovations in communications and computer technology will accelerate the pace of change by collapsing the information float. With the greater, and almost instantaneous, access to new information we cannot

afford to have the hierarchial barriers to an exchange of ideas and information that currently exists in organizations. He indicates that centralized structures are crumbling all over this country and that they are being replaced by the network model of organization and communication, which has at its roots in the natural, egalitarian, and spontaneous formation of groups among like-minded people. Networks restructure the power and communication flow within an organization from vertical to horizontal. Naisbitt describes decentralization as the great facilitator of change.

Kanter (1983) defines innovation as the generation, acceptance, and implementation of new ideas, processes, products, or services. She writes that we need to create conditions, even inside large organizations, that make it possible for individuals to get the power to experiment, to create, to develop, to test---to innovate. Individual employees can be energized and engaged in problem-solving by their involvement in a participative structure that permits them to venture beyond their normal work roles to tackle meaningful issues.

Lieberman (1984) writes that it is clear that the atmosphere and what is encouraged or discouraged among teachers are intimately tied to the behaviors of the principal. Any improvement effort involves the interpersonal relationships in the school, the predominance of the role of the principal, and the nature of the relationships among the teachers. In her study she refers to the work of Kurt Lewin and how this relates to school improvement efforts. Lewin described the three stages of change as groups are introduced to new ways of behaving. The

states were unfreezing, changing, and refreezing. Lieberman describes the theory as follows (Lieberman, 1983. page 91).

> "Lewin's descriptions speak to an initial period (unfreezing) where people are threatened by new ideas or confronted with different ways of looking at what they do. This is a period of great discomfort, where much support is necessary to help people receive new ideas. The second stage (changing) is characterized by participating in new ways of doing things. The third stage attempts to lock the ideas into one's repertoire. The stages are not discrete; it is often difficult to see where one stage ends and another begins. These descriptors are useful, however, in alerting us to ways of thinking and understanding how people grow and change."

Lawler (1980) defined organizational assessment as the process of measuring the effectiveness of an organization from the behavioral or social-system perspective. Effectiveness includes both the task-performance capabilities of the organization and the human impact of the system on its individual members. According to Schein & Bennis (1965) it is becoming increasingly clear that organizations have to develop mechanisms for two overarching tasks: (1) better means for human communication and collaboration, particularly between levels of hierarchy and between divergent specialists, and (2) better mechanisms for coping with externally induced stress and change.

Organization development (OD) is a response to change, a complex educational strategy intended to change the beliefs, attitudes, values, and the structure of organizations so that they can better adapt to new techniques, markets, and challenges, and the dizzying rate of change itself (Bennis, 1969).

Kurt Lewin in his pioneering analysis of the process of change in individual and group performance suggested three phases of "unfreezing,"

"moving," and "freezing." Lippitt's (Lippitt, Watson, & Westley, 1958) study of the work of change agents suggested that these three could be expanded to five phases:

1. Development of a need for change ("unfreezing).
2. Establishment of a change relationship.
3. Working toward change ("moving").
4. Generalization and stabilization of change ("freezing).
5. Achieving a terminal relationship.

Lippitt further expanded phase three ("moving") which he described as the most trying time for both the client system and change agent, into three separate phases of: 3a) the clarification or diagnosis of the client system's problem; 3b) the examination of alternate routes and goals; and 3c) the establishment of goals and intentions into actual change efforts. Data collection, diagnostic skills, and processing of information, all occur in these important phases (Lippitt, Watson, & Westley).

Planned change originates in a decision to make a deliberate effort to improve the system and, in many cases, to obtain the help of an outside agent in making the improvement (Lippitt, Watson, & Westley). This decision to change may occur due to pain and disorganization which arises from finding that the familiar way of behaving no longer works in a new environment or in one that has been altered. The resistance which might arise in the change process includes a general opposition to change, actual ability to change, opposition to a proposed change objective,

and a desire to preserve existing satisfactions (Lippitt, Watson, & Westley).

Lippitt writes that groups, organizations, and communities all reveal at least similar distinct phases: periods of growth and expansion, periods of stability, and periods of decline. It is during the periods of decline and difficulty that the motivation for change may occur and thus the need for a change agent to work with the system. The agent may concentrate on changing the distribution of power within the client system, or altering its characteristic ways of mobilizing energy, or in correcting its patterns of communication (Lippitt, Watson, & Westley). He wrote that many of the so called "group dynamics" techniques aim at redistributing power in the group so that it can be guided by the will of its members instead of by tradition or by the ideas of a few persons in positions of central power. The more energy that the group or organization expends on internal conflict, the less it will have available for carrying out its major purposes.

Lippitt wrote that it is time which provides the compass within which all change occurs. The new ideas or skills or feeling--whatever has been accumulated--are integrated with the old. A new gestalt is created which carries the system beyond its previous state of awareness and being. The formation of this new gestalt is what forces the system to move; the formation of the new gestalt is what is meant by change (Lippitt, Watson, & Westley). The model of research utilization to facilitate educational change is a process requiring supportive collaboration between people (Jung, Lippitt, 1966). The authors outlined four major kinds of needs that must be met in order to realize effective

utilization of scientific knowledge: a need for collaboration between researchers and educational practitioners; a need for the university setting and the school system each to explore the use of new functions to support the utilization process; a need to identify and develop training resources; and a need for research on the process of utilization and on institutional structures to support it.

Likert (1953) states that one of the most difficult and important problems for the social scientist who is serving as a consultant is that of getting an accurate picture of just what the operating problem is so that the consultant may be able to select and interpret relevant research results and theoretical generalizations developed elsewhere. Likert writes that cooperation in seeking and achieving change grows out of honest participation with full recognition and appreciation of the important ideas that the many kinds of people involved can contribute.

Hoyle, English, & Steffy (1985) refer to the climate theory base and its origins with the work of Kurt Lewin in organizational dynamics. They wrote that the first step in promoting good school climate is to create an awareness of climate and to assess the climate of the school or school district. In promoting instructional improvement, the collaborative effort of school administrators, teachers, and outside resource people provides a more vigorous and productive leadership arrangement than does reliance on any of these roles alone (Fox, Lippitt, 1964). Innovative efforts by the classroom teacher, with informed and sympathetic support from school administration and professional colleagues are much more likely to succeed than attempts without such support.

According to Miller (1978) organizations and people change when: (1) they hurt, are uncomfortable, or perceive a difference between internal goals and what is happening; (2) they are forced by external circumstances which create the need to change; (3) they perceive that to maintain the status quo is to lose and they place a high value on winning; (4) they place a high value on the projected or new condition that will result from change; (5) the risks of change are perceived to be within the range of tolerance; (6) the change process can be made reasonably comfortable; (7) they are no longer forced by climate, or friends to maintain the old position (reduction of resistance to change; (8) they find a climate of acceptance and support for change from other people (increase of acceptance); and (9) they have experienced positive results from prior changes. Some faculty resistance to teaching innovations stems from a skepticism about whether such approaches are superior to conventional methods in terms of instructional costs, learning time, and especially improved quality of student learning (Knapper, 1982).

There are four levels of change: knowledge changes; attitudinal changes; individual behavior changes, and group or organizational performance changes (Blanchard, & Hersey, 1982). The authors indicate that the change effort, which begins with the identification of the problem(s), involves an attempt to reduce discrepancies between the real (actual) and the ideal. There are four basic ways in which we change our minds when we get new and conflicting information: (1) change by exception- our old belief system remains intact but allows for a handful of anomalies; (2) incremental change- occurs bit by bit, and the

individual is not aware of having changed; (3) pendulum change- the abandonment of one closed and certain system for another; and, (4) paradigm change- the new perspective, the insight that allows the information to come together in a new form or structure (Ferguson, 1980). Ferguson emphasizes the point that no one can persuade another to change. Each of us guards a gate of change that can only be unlocked from the inside; we cannot open the gate of another, either by argument or emotional appeal (Ferguson). Changes in perception and attitude open the way for real behavior changes (1951). Whether or not teachers are resistant or receptive to an innovation is a function not only of the merits of the innovation, but also of the teachers' own values, personality traits, and needs (Schiffer, 1980).

Most of the significant changes in practice imply and require some changes in the attitudes and skills and values of the practitioner in order for the change to be a successful adoption (Lippitt, 1965). Lippitt writes that the process of innovation, and diffusion requires a different level of involvement in the process of change in the educational practices in order to stimulate and support a good quality of change as compared with that in most other fields.

There are perhaps four major components that influence the process by which individuals become aware of, evaluate, and finally accept or reject an innovation: (1) to begin with, there is the innovation itself- a new idea or a new cultural object, though even in the latter case it is the idea about the object that is diffused; (2) there is the process itself, beginning with the introduction either from within or without the social system, its promotion, and final adoption; (3) there are the

characteristics of the individual or groups which make up the social system; and (4) there is the nature of the social system itself, the context into which the innovation must be incorporated (Evans, 1982). According to Evans the individual confronted with an innovation will determine its relative advantages largely on the basis of whether he or she thinks it is superior to the ideas it supersedes.

What does an innovative organization have to be and how does it have to be structured and managed (Drucker, 1974)? According to Drucker, the innovative organization, the organization that resists stagnation rather than change, is a major challenge to management. The challenge to the superintendent of schools is to develop an ability to transfer a knowledge of change theory to its application in the instructional setting. The utilization of a change model such as that developed by Lippitt, Watson, & Westley (1958) will be of assistance in the identification of the many important variables that are involved in the change process. How can scientific knowledge be used to contribute to an orderly and creative process of planned change in education (Jung, & Lippitt, 1966)? Jung and Lippitt define planned change as the inclusion of certain basic problem-solving phases in adapting to an action concern. These include (1) identification of the concern; (2) diagnosis of the concern, involving retrieval of relevant knowledge and derivation of implications from that knowledge; (3) formulation of action alternatives; (4) feasibility testing of selected action alternatives, including training and evaluation; and (5) adoption and diffusion of successful alternatives (Jung, & Lippitt).

Wolf (1985) and his associates have focused their research on linking knowledge production and needs of knowledge users. They have described the variables of importance to the linking process: conditions for change; the characteristics of the innovator or linker; the characteristics of the innovation; the characteristics of the adopting units; and the characteristics of the linkage or diffusion strategy. Four major factors specifically related to knowledge transfer include: (1) characteristics of the innovation itself, i.e., credibility, observability, relevance, relative advantage, ease in understanding and installation, compatibility, etc.; (2) characteristics of the potential users, i.e., ability, values, circumstances, timing, obligation, resistance, yield, and the additional factor of leadership style that sets a role model of willingness to entertain challenge of one own's operation- a style that encourages a nondefensive, self-renewing organizational climate; (3) manner and extent of dissemination- early involvement of potential users in the planning, research and development; technical assistance from a knowledgeable consultant; personal contact; and, (4) some additional factors- leadership that provides encouragement, positive reinforcement, direction, and timely follow through (Glaser, Abelson, & Garrison, 1983). These authors categorize the various ways of transmitting knowledge under three headings; personal communication, written communication, and other forms of dissemination/diffusion. Their review of the literature has emphasized the primary importance of interpersonal communications for stimulating an interest in new ideas.

In educational institutions change is a process, not an event (Hall, & Loucks, 1978). The reality is that change takes time and is achieved

only in stages. Staff typically progress through stages of concern about new programs of any kind (Dianda, 1984). These include personal, informational, and management concerns, as well as concerns about the innovations' effect on students. A study conducted by Sparks, and others (Sparks, Nowaskowski, Hall, Alec, & Imrich, 1985) concluded that teachers can be a powerful force for school change when they are allowed to participate in rational problem-solving and responsible widely shared decision-making. The change process in an organizational setting is far more complex than the simple act of decreeing that a new approach will be adopted by all in the system (Knesevich, 1984). Knesevich writes that the starting point in educational change management is the development of a formal, systematic, and continuing pattern of searching for and identifying that which may help the organization to perform more effectively. The model of the innovation process includes: (1) disequilibrium; (2) conceptualization; (3) identification of design for invention; (4) experimentation; (5) evaluation; (6) pilot programs; (7) diffusion; (8) successful installations, and (9) new balance of equilibrium (Knesevich, 1984). Organizational change consists of a series of emerging constructions of reality, including revision of the past, to correspond to the requisites of new players and new demands (Kanter, 1983).

Today, school staffs have become relatively stable, therefore, change must be accomplished by working with existing personnel in staff development programs (Schiffer, 1980). The term staff development implies that changes in teacher performance should be linked with other aspects of school renewal such as improvements in curricula, programs,

administrative procedures and school community relations (Schiffer). According to Schiffer, research on change process suggests that teacher participation in decision-making is a critical factor in teacher satisfaction, staff commitment to school goals, and innovative behavior. She indicates that planned change is more likely to be successful when decision-making is shared by all people at all levels of authority. Effective staff development is related to the development of an organization; it merges the personal growth needs of individuals in an organization and the formal institutional needs of the system (Hoyle, English, & Steffy, 1985).

Despite differences in context and format most staff development programs share a common purpose: to bring about change (Guskey, 1985). Guskey writes that the three major outcomes of effective staff development are changes in: (1) teachers' beliefs and attitudes; (2) teachers' instructional practices; and (3) student learning outcomes. Three important principles to consider when planning and implementing effective staff development programs include: (1) change is a slow, difficult, and gradual process for teachers; (2) teachers need to receive regular feedback on student learning outcomes; and (3) continued support and follow-up are necessary after initial training (Guskey).

Innovation adoption is a process rather than a decision point- a process that each innovation user experiences individually (Hall, Loucks, Rutherford, & Newlove, 1975). They indicate that the growth in quality of use of an innovation by most individuals is developmental. They envision a time in the not too distant future when it will be possible to access individuals within a school or college in terms of their level

of use and concern about a particular innovation and to select appropriate intervention strategies and tactics to facilitate their growth in the use of the innovation while minimizing the trauma of change (Hall, et al).

Researchers at the University of Texas have developed the Concern Based Adoption Model (CBAM) which provides a structure that takes into account each of the assumptions about the innovation adoption process (Hall, & Loucks, 1978). Three aspects of change form the basic frame of reference of the model: the concern that users express about the innovation; how the innovation is actually used; and the ways in which the innovation can be adapted to the needs and styles of particular individuals. Hall & Loucks have identified some key principles that have been suggested by research with the CBAM: (1) Be sure to attend to the teachers's concerns as well as the innovation's technology- there is an effective, or personal side to change. Too often change facilitators and teacher educators become all involved with the technology of the innovation and neglect to attend to the persons that are involved; (2) It is all right to have personal concerns; (3) Do not expect change to be accomplished overnight; (4) Teachers' concerns may not be the same as those of the staff developers'; and (5) Within any group there is a variety of concerns.

According to Hall (1979) case studies have demonstrated that an individual's concerns can move in developmental progression from those typical of nonusers of an innovation to those associated with fairly sophisticated use. The stages of concern about the innovation include:

refocusing, collaboration, consequence, management, personal, informational, and awareness. With the Concerns-Based Adoption Model (CBAM) change is viewed as a process rather than an event (Hall).

The rapid change-rate, which stems from an acceleration of technological innovation and scientific advance, has created higher orders of complexity and interdependence and a higher level of uncertainty than have previously characterized the human condition (Trist, 1970). An important challenge for teachers and administrators will be to maintain an up-to-date knowledge of the implications of this explosive trend. Access to information in the organization, both external and internal, will be of prime importance. According to Glaser (1983) the technology exists to improve communication with the development of information analysis centers that may eventually permit a much more efficient and less costly utilization of the world's knowledge. He describes communication as an essential mechanism for putting knowledge to use, for inducing desired changes, and for spreading knowledge and innovative change. Living in an information society requires new styles of leadership, new styles of participation, and an ongoing concern about teamwork and involvement (Cromer, 1984). Cromer writes that positive change is likely to result in schools where educators: (1) provide a vision of the direction for future change and an ongoing rationale of the need for change; (2) develop a data base and understanding of needed changes; (3) involve a variety of individuals and groups in identifying problems and solutions which can lead to the desired outcomes; (4) provide staff with knowledge and skills for the implementation of changes; (5) procure the financial, physical, and human resources

necessary for change; and (6) establish a monitoring system for identifying and reinforcing progress (Cromer, 1984).

Schiffer (1980) suggests that for successful change to occur the process of mutual adaptation must continue until the innovation is diffused throughout the entire school and incorporated as a regular part of the system. She indicates that change can be successful only under certain conditions: (1) the district must be committed to the change; (2) the principal must be open enough to become aware of teacher, community, and district needs during the change process, and the principal must support the teachers as they experiment (or fail); (3) the community must support the change; (4) there must be some "early adopters" who will serve as an example and raise issues with the others; and (5) there must be a peer group climate that invites dialogue and problem-solving activities.

The challenge to the superintendent of schools is the development of an organizational culture that supports innovation. Nothing is more important to modern organizations than their effectiveness in coping with change (Bennis, & Nanus, 1985). According to Havelock (1973) most research studies show that the administrator is the most important gatekeeper to change. The leader sets the tone, opens the door and provides the support even when he/she is not the change agent in a formal sense. The more the leader knows about the process of change, the better (Havelock). According to Drucker (1974) the innovative organization, the organization that resists stagnation rather than change, is a major challenge to management, private and public.

According to Bramble & Mason (1985) when introducing an innovation, the people who do the initial developing often fail to recognize that practitioners require information and training. Bushnell (1971) writes that installing the innovation requires a trained staff, the necessary resources and materials, objectives and procedures, and a well-developed plan for monitoring, feedback, and modification of the adopted procedures. The constraints and barriers which surround a school system must be carefully documented and understood before a potentially successful change strategy can be formulated (Bushnell). If one major reason that innovations introduced into educational and other kinds of organizations do not yield their intended effects is inadequate implementation, then it is important to examine and understand the circumstances and conditions facilitating and blocking implementation (Gross, Giacquinta, & Bernstein, 1971).

In the field of educational change policy, initiatives are often blunted by the realities of the school situation (Firestone, & Corbett, 1981). They indicate that a considerable body of research testifies to the difficulty in promoting constructive change in schools. The support of district staff for a change effort and the belief of team members that the effort will help solve a locally recognized problem are major facilitators of change efforts (Firestone, & Corbett). The greatest obstacles to changes in education are lack of self-knowledge, demands of managing large groups of students, isolation, poor training, and lack of vision (Brown, 1984). Hilton (1982) warns that while it is important to try to anticipate possible negative consequences of any major innovation, it is equally important to recognize that too much

advance analysis can be paralyzing and can sometimes serve only to forestall needed improvements.

The implementation of any new program is a complex, multi-stage process of institutional and individual learning; the problems and issues that dominate the process of implementing any new program change as the process evolves (McLaughlin, 1985). Public service institutions need to build into their policies and practices the constant search for innovative opportunity (Drucker, 1985). They need to view change as an opportunity rather than a threat (Drucker). Nothing is more important to the future of this country than a vibrant, equitable and resilient education system; and nothing is more needed to sustain such a system; and nothing is more needed to sustain such a system than enthusiastic and informed leadership (Brown).

A Summary of the Literature on the Key Factors to Consider in the Development of a Comprehensive Computer Education Program

Shane (1982) writes that our task is coping with and using constructively the new social environment that is emerging as computers approach an era of virtually exponential growth. Knesevich (1984) suggests that computers for instructional purposes did not begin to attract serious and widespread attention until the development of micro-processors or microcomputers enabled substantial reductions in costs. The microprocessor is likely to encourage a number of desirable changes and innovations in the overall scope of the school (Shane). Lee Hay, the 1983 Teacher of the Year, indicates that we are on the threshold of a new era that will alter all institutions of our society, but most

significantly, it will alter the institution of education (Hay, 1983). Gray (1984) writes that the use of microcomputers in schools is a striking example of an educational change that has both widespread and deeply felt importance. Unfortunately, however, technology and social change are out-racing our educational systems (Miller, 1981). Cromer (1984) writes that the increased pace of change alone plays havoc with social institutions such as education, which notoriously lag far behind economic and employment events. Like other institutions in our complex society, the educational system must cope with constantly accelerating changes and increasingly pressing needs (Hall, 1979).

Zamora (1983) writes that today's children are progressing toward a future where accessing, creating, and manipulating information products and services will be essential skills. Knapper (1982) suggests that the most important educational challenge is to discover and encourage appropriate uses of technology. By the early 1990's nearly every educated person will have some computer experience (Tenner, 1984). But Tenner asks the questions: what affect will computers have on the definition of an educated person and the nature of both general and professional education? What part ought they to play? And what difference will they make in the thinking habits of the estimated 50% of the work force in industrial countries who will be working with terminals by the year 2000? (Tenner).

This century has seen the introduction of media that had the potential to change what teachers do in classrooms, however, film, television, and videotape have all failed to realize their potential to enrich and broaden classroom practice (Bitter, 1985). Unfortunately,

the parallels drawn between the media and the computer are the major reason why many educators ignore computers as just another technological fad (Bitter). Bitter believes that the computer will not succumb to the fate for the major reason that teachers have most often been the ones behind the introduction of microcomputers into the classroom. Another important element is the way in which young people take to computers; not as just another obligation imposed by adult society but as a system that fits naturally into their lives (Friedrich, 1983). Yet, despite the rapid growth in numbers of computers in use and the quickening interest of students and faculty throughout the world, the information technology revolution has yet to be felt fully in educational institutions (Resnikoff, 1982).

Cetron (1985) projects that the evolution of public schools into the nineties will include a more flexible schedule for teachers and students and an expansion of curriculum to include greater emphasis on job-training skills and lifelong learning skills, such as problem-solving, decision-making, communicating, and the use of technology to schedule programs, people, and things. This same thought is reaffirmed by Miller (1981) when he wrote that the emphasis will be on acquisition of critical thinking and problem-solving skills rather than acquisition of subject matter. Bramble, & Mason (1985) write that the modern educational system should be able to produce enlightened citizens who think of learning as a lifelong experience and recognize the need for continuous upgrading of training and learning of new skills to respond to changing technology. They indicate that the decision to use computers in education as an object of study and as a way to deliver

instruction has placed educators on the path of the information age (Bramble, & Mason). Papert (1980) suggests that learning to communicate with a computer may change the way other learning takes place. Traditional curriculum content and instructional practices are certain to change as educators begin to master the art of using knowledge to react promptly and wisely to the difficulties created by the demands that accompany an era of inflogut (Shane, 1983). Cromer (1984) writes that students of the information age will need and increased ability to function in a technological world, but also must be prepared to work more independently, solve more complicated problems, and continue to expand their intellectual capabilities and skills throughout their lifetime.

Our expanding use of computers is changing working methods and skills at an increasingly rapid rate, and we will all need to be better prepared by our education than we have been to accept and adapt to these changes (Laver, 1980). Laver writes that few of us will spend the whole of our lives practicing a single set of skills. The recurring demand for new skills will mean that all of us will need periodic retraining, and our lives may come to resemble a series of sandwich courses, in which our education and training is distributed in slices throughout our active years, instead of being concentrated into one thick slab at their beginning (Laver). He proposes that all education, technical and general, must seek to provide students with a broad and solid foundation of fundamentals on which their future training and retraining can be built.

Technology catalyzes changes not only in what we do but in how we think (Turkle, 1984). It changes people's awareness of themselves, of one another, of their relationship with the world (Turkle). One pervasive trend is the rapid rate of technological development with the consequent impact on life styles, social organization of enterprises, and the political and economic systems of the community, state, and nation (Lippitt, & Lippitt, 1978). Cromer (1984) writes that the 'high touch' side of the information age is as vital as the 'high tech' equipment itself. She writes that high touch is a recognition that an increased reliance on the technology requires a simultaneous increase in uniquely human attributes and activities to maximize the usefulness of the electronics (Cromer).

There are at least three ways to approach an assessment of technological impact (Kochen, 1982). The first is pessimistic and assumes that the momentum of technological change will sweep us along, shaping the future in ways we cannot control and in directions we will not like. The second is muddling through. The third is optimistic in its assumption that we can shape the future toward what we value (Kochen). Papert (1980) proposes that computers can be carriers of powerful ideas and of the seeds of cultural change; they can help people form new relationships with knowledge that cut across the traditional lines separating humanities from sciences and knowledge of the self from both of these. Papert feels that we are at a point in the history of education where radical change is possible, and the possibility for that change is directly tied to the computer.

Leadership personnel in education must understand that computers are agents of change (Diebold, 1984). Blaney (1979) describes change as perhaps the most powerful force of present day international life; brought on by technological change. Blaney writes that the computer is the basis for much of society's industrial advance and its influence on future innovation is likely to be even greater than it is today. A key aspect of change is the tension that it develops in the individual, in the local community, in the nation, and in the larger world system (Blaney). Papert (1980) writes that educational innovators must be aware that in order to be successful they must be sensitive to what is happening in the surrounding culture and use dynamic cultural trends as a medium to carry their educational interventions. There is not, however, common agreement on what technological change means for the education of young people (School Research Forum, 1983).

A school system's decision to undertake a course of action to prepare students for a technological future must be followed by similarly strong commitments in four essential areas: professional development; planning and program development; curriculum development; and, financing and resource development (Cromer, 1984). In this context, the potential that computers hold for education is dramatic (National Center For Educational Statistics NCES, 1983). The authors of this report indicate that properly programmed computers can facilitate the teaching and learning process, can be used as tools in most subject matter areas, and can be used for administrative purposes. As an object of study, computers can prepare for a wide variety of new careers in technology (NCES).

The fact that microcomputers are present in a majority of schools does not necessarily mean that most students are getting sufficient exposure to them or that they are being extensively used (Becker, 1985). Becker writes that up until 1982, the impetus for a school to obtain microcomputers most often came from a single teacher. More recently, however, administrators have been playing a larger role in initiating first purchases (Becker). By the end of the 1984-1985 school year, according to an estimate by TALMIS, a marketing research firm based in Chicago, approximately 1.2 million computers were in place in the nation's schools (Brodinsky, 1985). By early 1985, 5000 to 8000 education software programs were available (Brodinsky). An issue of national importance may be that between two-thirds and three-quarters of the richest U.S. schools have at least one microcomputer, but about 60% of the poorest schools have none (Zakariya, 1984). Miller (1984) writes that in the last six years schools have become increasingly involved with computers, sometimes almost by accident, sometimes by actual design.

Lipsitz (1983) suggests that so far computers have been an "add on" item. By this he means that very little in the traditional operations of schools has been affected by the presence of computers. Lipsitz writes that educators must confront the fact that to be truly effective, computer usage in the schools requires a different form of organization of both curricula and organizational structure (Lipsitz).

Becker (1985) writes that many educators report that the use of microcomputers has led to increased enthusiasm for schooling; to students working more independently; to students helping one another and answering each other's questions; and to students being assigned to do more work

appropriate to their achievement level. In a survey conducted by Becker (1985) most of the teachers found that the microcomputers have had a greater effort on the social organization of learning than on increased student achievement. Conkling (1983) describes the computer as a tool which can be used effectively in education provided we are willing to make it a meaningful part of our curriculum.

Walker (1983) has identified seven main ways that today's microcomputer can contribute to education: more interactive learning; more varied sensory and conceptual modes; less mental drudgery; learning nearer the speed of thought; learning better tailored to individuals; more independent learning; and better aids to abstraction. In voicing a qualified vote of confidence for computers in education Walker has also identified some limitations of the computer which include: (1) microcomputers can supplement conventional education, but they can't substitute for it; (2) today's microcomputers are hard to use, and teachers prepared to use them are in short supply; (3) new products and systems are being created and marketed in such profusion, with such speed, and with so little standardization that systematic, long-term planning is nearly impossible; (4) good programs are scarce because creating them for today's microcomputer is difficult, time-consuming, and expensive; (5) we are only beginning to understand how to use microcomputers in education; therefore, it is easy for a school or teacher to err, look foolish, or do harm; (6) programs for teaching explicit, formal models can be created readily with known techniques, but it is much more difficult to use computers to teach subject matter that involves judgment, intuition, improvisation, and creativity; and

(7) microcomputers will not solve several of the most serious current problems confronting education--notably equity, school finance, and divergent public expectations.

Frenzel (1980) indicates that the personal computer may be what is needed to make computer-assisted instruction possible. This thought is reaffirmed by Lindelow (1983) who writes that microcomputers will revolutionize the delivery of education within this decade. The goal of individualized instruction is now within the grasp of the public schools (Lindelow, 1983). Slesnick (1985) reports that the vast majority of computer education research studies which have investigated computer use as a supplement to the curriculum, report increased student achievement in classes that use computer software. O'Shea and Self (1983) believe that computers can radically enhance the quality of education.

In a single classroom, desk-top computers will enable students to work at their own speeds and on different subjects at the same time (U.S. News & World Report, 1983). In every kind of setting, the emphasis will be on individualized instruction (U.S. News & World Report). Three ways that computers can help students include: computers are infinitely patient; computers can provide immediate feedback; and a computer provides individual attention (Swartz, Shuller, & Chernow, 1984).

Walker (1983) proposes that educators must first answer the questions: Is it worth it? Are the limitations too severe and the advantages too slight? Naiman (1982) has identified five critical issues: differential access to microcomputers; emergence of new roles

in response to microcomputers; lack of integration of microcomputers into elementary classrooms and curriculum; inadequate quantity and quality of software; and lack of knowledge about the effects and outcomes of microcomputers in education. Other problems cited by Naiman include a shortage of preservice teacher education programs, a shortage of inservice programs, and a lack of systematic information sharing. In a survey of computer experts, the response to the question of what's going on in educational computing in schools that bothers you the most, the answers were: far too many weak programs, uninformed decision making by school officials, and programs created for political reasons (School Tech News, 1985).

According to Naiman (1982) the most important first step for any school, or for any group of teachers is to create a plan for the acquisition and implementation of microcomputers.

Several states have taken strong leadership roles through the development of models for the introduction of microcomputers in local school districts. The New York Board of Regents has approved a strategic plan for the integration of technology in the State's classrooms, libraries, museums, and other educational and cultural organizations (Chion-Kenney, 1985). The plan attempts to address five key issues that have emerged with the growing influence of technology on the delivery of instruction: the training of teachers and administrators; the development of high-quality instructional materials; the use of electronic networks for the equitable and enhanced delivery of instruction; research and development on the applications and evaluation of current and emerging technologies; and the integration of technology

in the content and program areas of educational and cultural institutions (Chion-Kenney).

The State of Tennessee has mandated computer literacy instruction for all seventh and eighth grade students (Apple Education News, 1984). The curriculum consists of thirty 45 minutes lessons held in computer labs with one computer for every three students. The State solicited bids to provide the microcomputer equipment, service, and technical support to the school districts throughout the State. In May of 1983, West Virginia set out to ensure that every future high school graduate would be computer literate by the creation of a statewide network with a central library and electronic bulletin board housed at the State's Vocational Education curriculum laboratory (Cook, 1985). The network is directly linked to the State's 74 high schools and vocational technical schools. To prepare students for the practical applications of computer literacy the State Education Department is emphasizing the teaching of three basic software programs- word processing, electronic spreadsheets, and data-base management (Cook).

The quantity and quality of leadership in Montana's computer education program is largely the result of five projects funded by the National Science Foundation (NSF) (Dolan, 1983). In reviewing the plan for Montana, Dolan indicates that the first step in a successful computer education program is the selection of a key person as program coordinator. A computer education program will be more successful if a number of people are involved with the following steps: develop leadership and commitment; identify district needs; formulate a plan;

select software and hardware; plan your housekeeping; train your staff; and, implement the program (Dolan).

Bingham (1984), the computer coordinator for the North Carolina Department of Public Instruction, reports that the State Department has defined three primary technology goals for the next five-year period: (1) statewide on-line courseware review system; (2) a 100 percent response by school systems who have developed a local computer plan and have hired a computer coordinator; and (3) the establishment of computer competencies and possibly a computer education certificate for North Carolina educators. North Carolina has identified seven components of any computer literacy program: activities to overcome negative attitudes or fears; definitions of computer terms; familiarity with basic components of a microcomputer; what a computer can and cannot do; an introduction to computer programming; sources of information about computers and computer software; and the impact of computers on society (Bingham).

The New YorK State Department of Education has identified five overlapping stages that need to be repeated at regular intervals over a multi-year period: (1) preliminary planning- this includes developing a planning structure and process, establishing a broad sense of direction, gaining support and commitment form key groups; (2) curriculum planning activities- this includes the development of broad goal statements, development of student competency statements, development of curriculum objectives, development of instructional strategies and applications; (3) staff development- including identification of required faculty computer competencies, clustering of required

computer competencies, develop and provide training programs, develop and provide other staff activities, evaluate staff development activities; (4) instructional material and equipment acquisition- review curriculum objectives and instructional applications, determine course-ware needs, determine hardware needs, prepare procurement specifications; and (5) organization and implementation- which includes appoint program coordinator, establish logistical supports, establish materials and equipment support, and establish implementation support systems (Mojkowski, 1983). The Department does not advocate the development of a separate computer curriculum that runs parallel to, and does not integrate with the total instructional program (Mojkowski).

Many organizations and individuals, prominent in the literature, have also set forth models for implementation of computer education programs. Swartz and his associates (Swartz, Shuller, & Chernow) have proposed a four step process for computer acquisition: develop a rationale; conduct a needs assessment; develop an implementation plan; and acquire hardware and software. These authors have identified some key questions for which educators need immediate answers: What options are open in terms of overall policy on equipment? How do I get a model computer project initiated? What steps are needed to sustain and enhance an ongoing plan? (Swartz, Shuller, & Chernow).

In the study conducted by Rockman, White, & Rampy (1983) 21 policy issues related to the acquisition and use of computers were identified: (1) Curriculum issues- What roles will computers have in the school curriculum? Is there a specific need for "computer literacy" curricula, within the broader scope of K-12 curricular concern? Should all students

meet minimum competency requirements? What kinds of research should be done concerning educational uses of computers? How can educational agencies encourage realistic and reasonable plans and expectations related to the use of computers? How should resources be allocated to ensure equal educational access to computers? What organizational plans have been successful in introducing and managing the use of computers in schools? (2) Courseware issues- How can educational agencies promote the development of high quality, low cost, effective courseware for use with computers? How and by whom should computer courseware be evaluated? How can the results be disseminated? Is the unauthorized duplication of educational courseware detrimental to production and distribution of courseware? (3) Teacher related concerns- What do teachers need to know about the use of computers in education? Should certification requirements be established? What computer training should be required for teachers and administrators? How should the training differ? How does the introduction of computers into the classroom affect teachers and administrators personally and professionally? (4) Other constituents roles- What agencies should set standards (guidelines) for the acquisition, development, and dissemination of courseware and hardware? Should they also set standards for teacher certification? What role should business and industry play in the adoption and use of computer technology in schools? What other groups are interested in the use of computers in the schools? What is their influence? How should schools identify and use outside human resources to further the use of computer technology? (5) Acquisitions and funding issues- How high a priority should be placed on funding to support computers in the schools? How

can the introduction of computers assist in cost-containment in the educational enterprise? What standards (guidelines) should be established for hardware acquisition? What kinds of strategies are most effective for educators in dealing with vendors?

The Educational Technology Center at Harvard has been awarded a $7.6 million contract by the National Institute of Education to investigate ways in which the various technologies, including the computer, can have a positive effect on K-12 math, science, and computer education (Brady, & Levine, 1985). The Center's research is also focused on new technologies likely to be important educationally (Educational Technology Center, 1984). The Center has found that definitions of computer literacy by computer education experts stress the role of the students as user of the computer rather than as a recipient of computer base instruction (Educational Technology Center). A program model, therefore, should strongly consider the use of applications programs such as word processing, databases, spreadsheets, modeling, and simulations.

The Merrimack Education Center (1984) has developed a planning booklet for school district staff who have system-wide responsibility for designing and implementing a computer education program in their school districts. The guide is organized according to the five major steps in the process: (1) planning for technological change: preliminary activities; (2) integrating computers into the curriculum; (3) staff development; (4) hardware and software acquisition; and (5) organization and implementation (Merrimack Education Center). The primary assumption supporting this guide is that a comprehensive computer curriculum cannot be separated from the district wide

curriculum. Setting priorities for program development over the 3-5 year period to be addressed by the plan should not mean that existing activities be ignored. The planning committee should examine what applications are in place and determine how these "pockets of innovation" can be supported and incorporated into the program plan (Merrimack Education Center).

Steber (1983) writes that the rationale for computer education should involve systematic planning: (1) State the mission and goals of the projected computer education program. What is desired and why becomes a key question. What is the intent at the senior high level, the junior level, and the elementary level?; (2) An overall analysis is necessary. What, if anything, currently exists in the area of computers in system? What is the district currently teaching? What are students currently learning? What are staff members currently learning? (3) An appraisal should occur. What needs to be done in the areas of instructional computing, administrative applications, overall computer management, and staff development? ; (4) Plans for implementation should be clearly stated and built within a timeframe for accomplishment. How and when things should be done is the question to be asked; (5) an evaluation component that asks the question are we doing the things we intended to do and how well, should be employed. Careful planning will help to define both the immediate priorities and the long-term goals (Steber).

Sandery (1982) has outlined the essential factors in the continued growth of school computing which include: coordination and development by a well supported team of people with skills in educational computing; availability of suitable hardware; development of software that is of

immediate use to the average classroom teacher; and development of courseware curriculum material and support material for teaching a computing course and to enable the computer to be used as a general resource.

Wilson (1982) suggests the following guidelines: (1) identify interested and willing personnel in order to avoid a forced-feed situation; (2) start small while encouraging staff and student interest; (3) do "shop and compare"; (4) assess your current facilities to determine appropriate housing for your equipment; (5) in order to avoid departmental and/or student exclusivity, create or organize a computer education department that will service all departments and areas; (6) involve all staff members as rapidly as they are able and willing in order to avoid exclusivity; (7) consider becoming a resource for other school systems in order to enhance what you are doing; and (8) although difficult because of the highly developmental state of computers, set reasonable goals within the limits of the resources available.

Naiman (1982) writes that the most important single thing you can do to foster a successful computer program in the schools is to help create a climate of support both in the school and in the larger community. The Merrimack Education Center (1984) warns that despite our experience with innovations we often forget to overlook the reactions to a major change effort; when the intimidation of the technology is coupled with the general resistance to changes in the status quo, the potential for failure increases. As computers change organizations, they are bound to exert an influence on individuals (Sanders, 1973).

Experience indicates that teachers will resist implementing an instructional program that they have not had a hand in developing (Merrimack Education Center). The key to the efficient use of computers in education is to place the machines in the hands of individual teachers, with the clear understanding that these teachers can use their computers for whatever purposes they perceive as most appropriate (Wagschal, 1984).

In implementing change of any significant magnitude in a school system, one of the first steps to take is to map out a long-range plan (Cory, 1983). The Educational Technology Center (1985), located at Harvard University, advises that although the process by which innovation successfully takes hold in schools is not well understood, many people agree that planning is key to making the introduction of computers into schools successful innovations.

It has been demonstrated over and over again that when teachers are not involved in formulating, developing and carrying out new programs, their own effectiveness is undermined and they create barriers to change (Educational Technology Center, 1985). Sustained involvement in planning and monitoring is necessary in order to keep the image of improvement vivid and focused for teachers, to allow for collective teacher learning and growth, and to induct new teachers into the collaborative effort (Duckworth, 1983). Graham (1984) suggests that even if a statement of educational purpose attracts interest and support, its acceptance in the schools as a guide for educational practices will take a long time. Innovations often do not gain acceptance immediately, even when they offer obvious benefits (Bramble, & Mason, 1985).

Wood, and his associates (Wood, Freeland, & Szabo, 1985) write that the target of change is no longer the district or individual staff member, but the school. The principal, as a key leadership person in school improvement, must learn how to facilitate improvement in the school, particularly in the areas of instruction, shared decision-making, and managing change. Schools should have a systematic improvement process that involves students, parents, teachers, administrators, and community leaders in selecting goals, planning programs for improvement, and implementing staff training and on the job assistance (Wood, Freeland, & Szabo). According to these authors the primary means of achieving improvement in student learning is not curriculum development but staff development for all professional personnel.

An unprecedented re-tooling of the present teaching force will be required as most educators completed teacher training prior to the emergence of computers, of any kind, on the college campus (Grossnickle, & Laird, 1983). These authors have proposed a prescription for designing successful and long-term microcomputer innovation based on these principles: (1) an awareness of available research on innovation and planned change; (2) an awareness of literature describing successful inservice/staff development activities; (3) recognition of the special motivational problems likely to be encountered by "computer-phobic" faculties; and (4) designing a systematic and local approach for motivating and training teachers while they develop skills to use, program, and teach with microcomputers.

One of the first major obstacles to overcome in initiating a comprehensive training program is the use of computerphobia or

technophobia (Naiman, 1982). It makes sense to build on existing strengths of staff and add external resources as you feel you must have them. The process of learning is gradual: awareness, interest, trial/approval, and finally adoption (Naiman). A study conducted at the University of Northern Iowa provides evidence that the failure of inservice programs to attend first to the self-centered fears of teachers may lead to rejection of the new technology (Bracey, 1985). Trainers need to be sensitive to teachers' emotional reactions to the computer and structure the training in a nonthreatening atmosphere (Pratschner). According to Miller (1984) it is not difficult to look at some of the constraints that staff and faculty feel about technological change- intimidation by the technology, fear of job loss and bad experiences with machines, unsubstantiated promises about hardware, and bias against mathematical computation. There is a sense of loss of professionalism, of replacement, of great inadequacy and ill-preparedness.

Personal and cultural traits affect the initial attitudes toward computer use, but after the beginning trepidations are overcome, individual self confidence, ample exploratory experiences, coupled with a conviction in the importance of computers seems to be the most promising indicators of increased computer implementation (Winner, 1983). Educational administrators who want to implement computers in classrooms do well to remember that teacher attitudes toward educational computing must be taken into consideration prior to implementation (Norris, & Lumsden, 1984).

Computer training for teachers should be designed to fit identified needs due to the fact that teachers in a school are bound to have different backgrounds and, therefore, different needs for such training (Bramble, & Mason 1985). Bramble & Mason feel that training for teachers should have four goals: (1) the training should demonstrate the advantages to be gained by using the computer; (2) as part of the training, teachers should be able to operate microcomputers and see them being used by students; (3) the training should emphasize any compatibility between doing tasks by computer and using traditional methods; and (4) the training should interest teachers in computer applications in the classroom.

According to Westley (1985) the vast majority of teachers who take computer workshops fail to use the technology once they're back in their classrooms. She indicates that the fundamental weakness of most workshops is that they fail to entice teachers with the usefulness of computers. Instead of showing teachers how computers can be used to teach the basic subjects that teachers are charged to teach, too many workshops still focus on programming, a topic whose benefit is not immediately clear to those new to computers. The better workshops concentrate on the uses of tool programs- word processors, databases, spreadsheets, graphics utilities and the like- in the classroom (Westley, 1985). Westley feels that any effective inservice computer training model should include provision for ongoing, preferably onsite, support for neophyte teachers. A central part of the training must be practical (Hawkridge, 1983).

The human resource most important to creative and effective use of educational technology are teachers who understand how, when, and when not to use technology to augment or replace existing educational practice (Educational Technology Center). According to Coburn and his associates (Coburn, Kelman, Roberts, Snyder, Watt, & Weiner) what is needed for effective staff development in educational computing is an ongoing inservice program: (1) seriously consider having your own school system "experts" run the workshops so that they are available for follow-up questions or problems; (2) hands-on experience at the computer is critical; (3) be sure that initial exposure includes a strong dose of non-math experiences, such a word processing; (4) promote a positive attitude of working together, of expecting to need help, and of seeking help; and (5) encourage experimentation at all times.

Mojkowski (1983) believes that staff development, like the implementation of a comprehensive computer instruction program, is an ongoing process, not a one-shot affair. The training must be an ongoing program that raises the level of competency of all the staff and keeps them somewhat abreast of this fast moving, changing technology (Dolan, 1983). Swartz and his associates (Swartz, Shuller, & Chernow, 1984) propose that any curriculum that aims to meet the needs of teachers with disparate backgrounds and comfort levels in computers should emphasize the following themes: (1) appreciation of the major historical developments of computers; (2) understanding the impact the computer can have on the teaching process; (3) awareness of the difference between "teaching with computers" and "teaching about computers"; (4) understanding how to use computers effectively as an aid to instruction and

comprehending their advantages and disadvantages; and (5) insight into the major problems involved in the integration of computers into education.

According to Pogrow (1983) the key competencies that teachers need are: (1) the ability to evaluate the quality of instructional software; (2) the ability to use a wide variety of existing programs, and (3) some understanding of how to integrate computer-delivered instruction into the overall educational process. Fary (1984) suggests that teachers should be aware of the capabilities and limitations of computers; be able to make informed judgments about the social and ethical issues involving computers; be familiar with the application of computers to teaching in their subject area; and be familiar enough with the skills of programming so that the computer is demystified for them.

Teacher training, as well as professional development for all educators, often is regarded as the key to making technology a viable educational tool (Cromer, 1984). Dolan (1983) indicates if a preservice teacher has a great deal of experience using the computer, there is a greater possibility that he or she will use it later as a teaching tool. Pogrow (1983) suggests that one of the structural barriers likely to impede the large scale use of technology in the public schools is the lack of qualified faculty in colleges of education to offer quality pre- and inservice training to personnel in the application of technology.

Bramble, & Mason (1985) feel that as computers are woven further into the fabric of our society and its schools, training of teachers in computing will probably become more formal and widespread; with certification standards and semester-hour requirements like those now

established for other areas of education. They propose that the training should include: general education technology; history of computing; social, ethical, and economic issues in technology; programming languages and structured programming; introduction to computer design and operation; data management techniques; graphics applications; operating experience with difference kinds of computers; and futuristic studies in technology and its effects (Bramble, & Mason).

Pogrow (1983) writes that using computer-based technology to alter delivery systems in education not only influences one's notion of professional practice but also has implications for redefining research practices and teacher training strategies. If teachers will not be teaching all that will be taught in schools, then (1) teacher training institutes do not have to teach teachers to teach everything, either in pre- or inservice programs, and (2) research needs to focus on determining what should be taught via technology, as opposed to intervention, under different conditions of technological opportunity (Pogrow).

Dolan (1983) suggests that the essential features of teacher preservice education should include: (1) the computer should be incorporated into instruction when and wherever appropriate; (2) the computer should be used as a tool for problem-solving, simulations, and assignments; (3) students should explore a variety of ways that they will be able to use the computer as an instructional medium in their classroom; (4) students should be exposed to a broad spectrum of software appropriate to their teaching fields and grade level certifications; (5) preservice training should include an exploration of the impact that

computers have on education and society; and (6) students should become familiar with utility programs such as word processing, data base managers, student record keepers, and worksheet generators.

The fact that microcomputers are present in a majority of schools does not necessarily mean that most students are getting exposure to them nor that they are being extensively used (Center for Social Organization of Schools, 1983). The typical microcomputer-owning elementary school has two microcomputers, each used for about 11 hours per week, or a total of 22 hours of use per week by students under the direction of a teacher or other staff member. About 62 students (in the student body of 400) share these 22 hours of use, which is equivalent to about 20 minutes per user per week (Center for Social Organization of Schools). The typical microcomputer-owning secondary school has approximately five microcomputers, each in use for 13 hours per week, or a total of 65 hours of use. About 80 students (in a student body of 700) use the equipment in an average week--- a little more than 45 minutes per week (Center for Social Organization of Schools).

The initial focus of the "computers in schools" movement was the computer as machine (Apple Education Affairs Grant Program, 1985). Currently there is a shift toward integrating computers into the curriculum; using them as tools for learning and teaching. Often, other than computer literacy classes, there is no overall school or district plan for implementation of microcomputers and other technology (Apple Education Affairs Grant Program). According to the experience of this program, bringing technology into schools involves innovation and change.

Whether innovations take root and bear fruit or wither on the vine depends upon whether the school as a social system is organized to be able to accommodate and support change.

During the past several years, educators have witnessed the inclusion of microcomputer technology into school systems with poor information and preparatory planning, few objectives, and little substance beyond short and long term implementation strategies (Church, & Bender, 1985). Introducing computers into the school curriculum is different from other changes a school system might wish to make: (1) there is not an already trained staff of teachers who learned what to do with computers while they were learning how to be teachers; (2) there is not enough money available at the outset to purchase all the materials that will ultimately be needed for full computer utilization; and (3) there is no historical precedent for a school system to select the best plan for its particular situation (Cory). The use of computers in schools has sometimes progressed in a haphazard manner because there has been no clear definition of responsibility and authority for their use (Ragsdale, 1982).

Since computers are just beginning to be widely used, the directions we set in the next few years will be critical in determining whether their potential as tools will ever be fulfilled (Kleiman, 1984). Changing technology is generating new educational needs that require comprehensive curricular reform (Pogrow, 1983). According to Bork (1980) we are at the onset of a major revolution. Dwyer (1980) believes that computing, placed in the hands of well-supported teachers and students, can be an agent for catalyzing educational accomplishments

of a kind that is without precedent; he believes that there has simply been no other tool like it in the history of education.

Summary

In this chapter this writer has summarized a review of the literature on: the role of the effective school leader; the innovations/change process in organizations; and, the key factors to consider in the development of a comprehensive computer education program. The overall purpose of this review was to develop the linkage among leadership, change, and computers in education. In this study the microcomputer represents the change agent that may ultimately impact on the teaching and learning process in the public schools.

This review has provided evidence that many school districts are acquiring substantial amounts of computer hardware and software without adequate planning and consideration for a variety of organizational factors which impact on students, school personnel, programs, and facilities. Perhaps the most important organizational element to be considered is the impact on the classroom teacher. If the microcomputer is to become a tool in the educational process then provisions must be made for the training of teachers. For it will be the classroom teacher who will ultimately determine the success or failure of the microcomputer as an instructional tool.

The literature review has also identified the individual school as the key unit for effective change in education. The research on effective schools has emphasized the importance of the school principal in providing both the vision and the leadership for improvement in the

quality of educational opportunities for students. The school principal must be sensitive to and knowledgeable of the process which individuals must go through that may eventually result in the adoption of an innovation. Change is a process, not an event.

This chapter has developed the information base required for leaders who will be responsible for the implementation of the management plan.

CHAPTER III

DEVELOPMENT OF THE MANAGEMENT PLAN

Introduction

The review of the literature provided evidence that school districts are acquiring substantial amounts of microcomputer hardware and software without adequate planning and consideration for a variety of organizational factors which impact on students, personnel, programs, and facilities. This study has focused on what this writer considered to be the single most important factor for the introduction of microcomputers into the instructional process which is the development of a comprehensive management plan. This study has set forth the essential components of a management plan based on both a review of the literature and on the experiences that this writer has had in introducing microcomputers into a public school district. The outcome of this study has been the development of guidelines for the school administrator on the types of intervention strategies that could be utilized to more effectively introduce computers into the instructional process within the resources that are available.

Chapter II focused on the theme that to successfully incorporate any new program into an organization requires an effective blending of leadership skills, an appreciation and sensitivity for the process of change, and a knowledge of the elements of the program itself (the new innovation). This careful blending must occur if the program is to become an inherent part of the organization. If the new computer technology is to be successfully incorporated into the operation of

our schools then we must devise an effective planning process for our school leadership personnel and for all other levels of the organization.

The literature review emphasized the primary importance of the school administration in the implementation of new innovations in the school organization. Joyce, Hersh, & McKibbin (1983) set forth five principles to follow in creating a homeostasis of change in schools: building collaborative local governance, building a climate of support; building effective training; building a sound organization; and making change familiar. Summers (1985) suggests that educational use of computers has moved through the knowledge and persuasion stages in most schools and generally, activities now center on decision, implementation, and confirmation. Successful implementation of a microcomputer plan depends on school personnel at all levels who are eager to support and implement the new technology (Kuchinskas, 1984).

This study has been significant in providing a condensation of information based on both the theoretical and the practical guidelines for the school administrator who has not carefully studied the implications of technology in the school setting. Oftentimes, school leadership personnel do not have the time available to conduct a thorough investigation of a particular innovation. This study will also set the framework for future research investigations.

For the purposes of this study the term school administrator referred primarily to the superintendent of schools. However, this study has also highlighted the importance of the building principal in the implementation of a computer management plan..

Assumptions/Research Questions

This study determined the administrative leadership practices that will be required to effectively manage and respond to the future impact of computer technology in schools. The following questions and assumptions have been assessed:

1. The leadership ability, including interest and attitude, of school district administrative personnel determine the degree to which computers will be used in the instructional process.

2. The prior experiences and training of school administrators determine the degree to which computers will be used in the instructional process.

3. The provisions made for support services (i.e. maintenance, training) throughout the school district will impact positively on teacher and administrator use of the computer.

4. A clearly defined plan for implementation of computer technology will enable the school superintendent to monitor and to intervene at certain key points when appropriate.

This study has focused on those factors which contribute to the successful implementation of computer technology in the schools.

Background Information

For the past eight years this writer has directed an effort to introduce microcomputers into the seven public schools of the Keene School District. Prior to that time the school district management personnel at both the central office and secondary levels did have access to a mainframe computer located at the central office. This

school district has an enrollment of 3922 students with an annual operating budget for fiscal year 1988-1989 of $19,300,000. This writer has served as the chief operating officer for the school district since 1983.

The Keene School District has undertaken a number of initiatives pertaining to the introduction of computers into the schools. These computers have been used in three ways: (1) as an object of study in computer science instruction K-12; (2) as an instructional tool in the various content areas; and (3) as a means to improve the productivity and efficiency of teachers, managerial and clerical personnel. These initiatives have included the following:

* the development of a comprehensive plan for K-12 computer education.

* the development of a K-12 computer science skills continuum initially written in 1983 and revised in 1985 and 1987.

* the acquisition of 375+ microcomputers now available for use by instructional staff and students K-12. This is a student to computer ratio of 8:1 compared to the current ratio of 76:1 for the United States.

* the development of a centralized process for evaluation, purchase, cataloging, storage and distribution of computer software.

* the development of a staff training program designed to address all levels of ability and interest pertaining to the use of the computer in the educational process. The training has been provided after school, during weekends, and during the summer vacation periods.

* direct access to the central office mainframe computer (Digital PDP11/44 and VAX 785) by the seven schools of the district

for automation of student management information, budget development, and other administrative applications. In July, 1986, a second mainframe was installed (Digital VAX 785 system). This system provides for additional applications including the automation of special education information and library services. The school district has maintained separate systems for administrative and instructional applications. All of the district's schools are on-line with the mainframe.

* access to software programs for the microcomputer used to computerize the development and revision of the individualized education plans for special education students.

* the employment of a Manager of Instructional Resources & Technology responsible for the coordination of all aspects of the K-12 Computer Education Program (August, 1985).

* the establishment of a K-12 Computer Education Committee responsible for monitoring all components of the district's computer management plan.

* the establishment of a loan policy for home use of microcomputers by instructional staff during school vacations and summer recess.

* the development of a professional library on the use of computers in education.

* the design and construction of microcomputer laboratories in addition to having microcomputers in the classroom.

* the development and publication of a copyright guide setting forth guidelines covering print, music, computer software, off-air copying, rental of videotapes from home rental studios, and other forms of audiovisual material and inter-library loan.

* development of a computer competency examination for grade eight students first piloted in June 1986.

* the acquisition of a Digital VAX 11/750 minicomputer with over 40 on-line terminals for computer science instruction exclusively at the high school/vocational center. This system will be replaced in 1989 by a Digital MicroVax 3400.

* the development and implementation of a number of elective course opportunities for students at the junior high and high school levels.

* the development of a plan for employees to purchase microcomputer equipment via payroll deduction. The employees receive the benefit of the district's large volume purchase prices.

* participation by professional staff in numerous national, regional, and State workshops on the use of computers in education. The Keene School District was one of the first ten school districts to join the Network of the National School Boards Association "Institute for the Transfer of Technology to Education" (ITTE).

* development of an approved grant application for training of staff in the interactive use of microcomputers and laser video disc players (June, 1986).

* the June, 1986 approval of a grant in the amount of $110,000 to purchase 70 Apple IIe computer systems and software for the exclusive use of classroom teachers for classroom management activities. The computers could be kept at the teacher's home for a period of three years (to June, 1990).

The school district has been recognized as a leader in the application of computers for both administrative and instructional purposes. This writer and other personnel in the school district have been

invited to a number of state, regional, and national conferences to present papers on the school district's experiences with computers. This writer currently serves on New Hampshire Governor John Sununu's Committee on Excellence in Education. The primary task of this committee is to identify and encourage initiatives for the application of computers and related technology to education. The committee is the decision maker for over $5,000,000 to be expended in the next fiscal year.

The school district's Director of Instructional Resources and Technology was appointed to the Education Advisory Council of Apple Computer, Inc. In June, 1986, this writer ran a workshop for New Hampshire school superintendents on managing technology in the schools.

This writer has experienced many of the pitfalls and many of the successes associated with introducing change in organizations through active involvement in school management for over nineteen years. It has been a specific interest in computers that led to the decision to apply for admission to the Doctoral Program in the School of Education at the University Massachusetts. The primary focus of the doctoral studies has been in the areas of school management, change and innovation in organizations, group dynamics, and the role of computers in education. Many of the current researchers and writers on the topic of technology in education are computer advocates who have not had the direct experience of this writer in managing a complex school organization.

The anticipated outcomes of an effective management plan for computers in the public schools, as indicated in the literature, would include: (1) improved student achievement; (2) improved

efficiency in managing all school operations; (3) empowerment of teachers, students, and administrators in managing larger volumes of information; (4) increased awareness of the efficiency of the computer as a tool for teachers and students; and (5) improved organizational accountability and decision making.

McMeen (1986) suggests that microcomputers will continue to occupy an increasingly important position as an educational delivery system as they become integrated into mainstream instructional activities. We now have an opportunity to use microcomputer technology as an integral part of the teaching process.

The key to the effective utilization of the microcomputer technology will be informed school personnel. Leaders who are capable of kindling enthusiasm in people; who are able to maintain levels of enthusiasm in all employees; who are able to manage a smooth operating program with a minimum of problems, while allowing the opportunity for creativity and experimentation and who are able to monitor and make the necessary adjustments in a short amount of time. Barriers to change in all organizations include deficiencies in planning, communications, dissemination, evaluation, and the quantity and quality of available information (McMeen).

Outline of Study

This study has developed a management plan. The plan was reviewed by selected school superintendents/educators in New Hampshire and selected superintendents of schools/and other educators from around the country whose school districts are members of the Institute for the Transfer of Technology to Education (ITTE) network sponsored by

the National School Boards Association. As of December, 1988, the network included 155 participating school districts from 34 states and Canada.

The ITTE was created in 1985 to offer member districts an opportunity to work with other leading districts to develop plans, policies, and procedures for use of technological tools. The network also serves as a liaison between participating districts and representatives of industry and government, between manufacturer and consumer, and between policy makers at the national and local levels.

The New Hampshire superintendents were selected in consultation with Dr. Robert Brunelle, currently the Executive Director of Governor John Sununu's Committee on Excellence in Education. Refer to Appendix C for a description of this program. The superintendents/educators from the ITTE were selected in consultation with its executive director, Dr. James Mechlenburger. Others who were asked to review the plan include Dr. Sylvia Charp, Dan and Molly Watt, and Dr. Thomas Blaylock.

The selected superintendents of schools/and educators were requested to review the plan. As membership to the ITTE is by recommendation, the writer must assume that all of the districts have been involved in some degree of activity associated with the implementation of computer technology. The New Hampshire school superintendents were selected based on consultation with officials at the New Hampshire Department of Education on the basis of perceived leadership in the utilization of technology in their school districts.

Protocol Reviewer Reaction Survey

In late April 1988, a packet of information was sent to twenty-nine individuals requesting their review of and reaction to a management plan developed by this writer. They were asked to respond by May 15, 1988. As an incentive for them to respond by that date I had indicated that I would forward to them a tri-state megabucks ticket. I also indicated that I would provide them with the final version of the management plan.

The packet included a letter, a reviewer reaction form, and the management plan as it existed to date. These items along with the directory of reviewers are in Appendix A.

A follow up letter was forwarded on June 2, 1988 to those who had not yet responded.

Twenty of the surveys were returned. This represents a return rate of 68 percent. One-third of the respondents rated themselves as expert in their knowledge of computer technology. On a scale of 1 to 10 (expert) over 70 percent rated themselves above the level of eight. Eighty-nine percent of the respondents reported that the plan was very useful; 11 percent indicated that it was of some use. No one rated rated the plan as not being very useful.

Many of the reviewers made extensive comments on the reaction sheet as follows:

"Substitute the word technology for computers. Describe the organization chart....report to whom? Where does the K-12 coordinator fit in? Plan does deal with the issues of a significant educational innovation. Plan exemplifies the best practice we know in 1988. A

model plan. Very proactive and establishes a good framework for further work to be done. Keep everyone involved. Well thought out. Very good and helpful. This plan would be beneficial to anyone involved in planning all aspects of a technology program....would help to avoid pitfalls. Very well written. A good checklist for the development of a plan. Gives the big picture....the details that have to be considered. Very understandable and well written. Would like illustrative examples for each component. Excellent and realistic.

"Elaborate on what constitutes critical mass. Needs assessment should be conducted. Who develops the plan? K-12 technology committee? Important is the concept of a vision by central administrators. Must allow for creativity so that it will not be a strait jacket. Think that a K-12 coordinator should be first in the implementation of a computer plan. More emphasis on the computer as a tool and problem solver. Standardize use of the computer guidelines for all schools. Keep library/media as a strong component. Likes 2-3 year plan versus a five year plan. Members of the board of education should be provided the opportunity for some hands on experience.

"Excellent....very inclusive. Needs two plans; one for instructional use and one for administrative Want a K-12 coordinator at the beginning. Definition of computer education could be expanded to include the ways that computers and related technologies can be utilized to enhance learning and teaching. Agreement with all points. Philosophy should include something about computers can be used as a tool by each student. Include educating the school board in

addition to informing them. Plan ensures an orderly process. Agrees that central office must be behind the vision. Plan should outline the instructional uses of computers for special education. What about public awareness and opportunity for input at planning stage? Explain how to accomplish the outcomes."

Based on the reactions of the reviewers the management plan was rewritten and is included in Chapter IV.

Protocol for Interviews

An additional component of this study involved a structured interview of the twelve school principals (Appendix B) of the Keene School District to determine their view of computers in the schools based on the experiences that they have had in working within the plan proposed for this study. All of the principals have been continuously employed in the school district since 1980. The interviews were conducted by the district's Director of Instructional Resources and Technology during May and June of 1988.

Deborah K. Couture, Director of Instructional Resources and Technology for the Keene School District, conducted the interviews of school principals based on a standardized format developed by this writer and included as Appendix B. The interviews were conducted in May of 1988.

Results of the Interviews

* The average years of experience in education for this group of principals was 22 years.

* Nine of the principals described themselves as "hands-on" users of a microcomputer; while three indicated they were not.

* On a scale of 1 to 10 (10 = expert) 75 percent rated their knowledge of computers as four or better.

* The primary source of computer and technology information for the principals came from the computer coordinator, computer dealers, and peers.

* There were mixed signals as to whether or not the implementation of computer technology into the classroom has resulted in changes of teaching styles.

* When asked in what areas did they feel that students were benefiting from these changes they responded as follows: creative thinking, writing process, instruction more individualized, students as independent learners, recordkeeping for teachers, utility for handicapped, simulations, and has not been fully realized.

* Ten responded that decisions on the selection of software were made on the basis of skills to be taught at a particular grade levels.

* The group most responsible for the introduction of computers into the schools was the central office, followed by principals, teachers, school board, parents, and students.

* When asked where they had received their most significant computer training the response was district inservice programs and self-teaching.

* There was unanimous agreement on the following issues: our students should have more access to computers; the application of computer technology in our schools is helping our students to

learn; teaches should receive recertification credits for courses designed to teach them how to utilize computers in their classrooms; and computers enhance my school's productivity.

* There was near unanimous opinion on the following: the technology training provided by our school district has benefited me; teachers should be encouraged to purchase their own computer; more computers should be placed in the classrooms; and teachers productivity is enhanced by their personal use of computers.

* All of the principals responded yes to the following statements: microcomputers will be an essential instructional tool for the future; and all students should become computer literate.

* When asked to indicate the inhibitors for using computers in schools they indicated that the most significant problems were: lack of access to terminals or microcomputers; funding for computers; and difficulty with effectively managing student use of computers.

* On the other hand they indicated that the following were definitely not a problem: lack of administrative support; difficulty with integrating computer taught skills with the remainder of the curriculum; lack of student interest; and lack of teacher or staff interest.

* The most significant advantages for using computers in teaching were: providing immediate feedback; patience; keeping the learner actively involved; providing self-paced instruction; keeping records of student performance; and, providing, through simulations, experiences otherwise not possible in the classroom.

While the design of this study involved the schools of Keene (N.H.) School District, this writer expects that the outcome of the study has

application for school leadership personnel at all levels. Although the schools in Keene have operated under the same framework, there are differences that exist among the schools in the way that the computers have been utilized. This study attempts to evaluate strengths and weaknesses and to formulate possible intervention strategies which could result in more effective use of computers. This study is unique in providing a blend of both theoretical information and practical application. This study should be useful for both public school practitioners and computer advocates (private sector and higher education) not employed in the public schools.

For an innovation to be successfully adopted in an organization it must become integrated in such a way that it becomes routinized. The key issue for the school administrator will be to implement a process that enables the innovation to become totally integrated into the life of the organization.

Limitations of Study

A source of difficulty could have been willingness of the selected group of superintendents/and educators to complete the survey as requested. Superintendents are bombarded by a large number of requests to complete a variety of survey forms. Therefore, the request from this writer could have been easily overlooked or discarded.

It was recognized that another potential source of difficulty in the study could have been the role that he plays as the chief operation officer for the Keene School District. The district personnel are certainly aware of his interest in the application of technology. Attempts were made to minimize this effect by the manner in which the study was conducted, by training others to

conduct interviews, and by attempting to clearly explain that there could be no benefit to overstating or misrepresenting current use of technology, or in fact, hiding problems. Conversely overstating or misrepresenting current use of technology could have a negative impact on the future allocation of resources. The outcome of this study was not to prove, but rather to improve, the current utilization of computers in the schools.

Instrumentation and Methodology

This study has designed a management plan that could be utilized by school principals and other administrative personnel concerned with the management of computer technology in the schools.

All of the data collection methods recommended in this study have been related to the elements of the computer management plan outlined in this proposal. The plan could be utilized periodically with various levels of the organization to monitor issues of importance and to provide continuous information or feedback.

Included are copies of instruments that were used. Appendix A is the review outline that was mailed to the selected group of school superintendents of schools and other educators. It consists of two parts. Part I asks both demographic questions and questions about the respondents' feelings about the relative importance of computers in education. The questions Part II are related directly to the components of the management plan developed by this writer. The respondents were asked to rate the relative importance of each of the components. It is important to point out each component should not be regarded as a discrete step but rather as a continuum of

overlapping and interrelated events that should occur during the implementation of the plan. The primary outcomes of this study has been to finalize the design of this plan for use by school administrators in other school districts.

Appendix B is the structured interview format that was used with the twelve school principals in Keene. To reduce anticipated bias this writer trained the Director of Instructional Resources & Technology to conduct these interviews. The principals were asked to respond to a series of 34 questions. These questions have undergone extensive revision with several of them adapted from a survey developed by D. LaMont Johnson (1985).

The interview format was field tested with two elementary school principals not directly associated with the Keene School District.

Description of Population

The population for this study consists of the superintendents of schools whose districts were enrolled in the ITTE Network as of May 1, 1986. In addition, this writer consulted with appropriate officials at the New Hampshire Department of Education to identify superintendents of schools whose school districts are recognized as leaders in the application of computer technology. There are a total of 56 superintendents in New Hampshire. The school principals in the Keene School District were also involved in the study.

The Keene School District consists of 256 full time classroom teachers.

The average age of the teachers in Keene is 44 compared to a national figure of 40-43. More than 64% of the Keene teacher have

more than 12 years of experience; 14% 9-11 years; 17% 4-8; and 5% have less than 3 years of teaching experience.

The average years of experience for the 79 elementary teachers is 15 years. Each of the five elementary schools have a full time supervising principal. The average years of experience for the Keene elementary principals is 20 years.

There are 477 microcomputers available for use by the 256 teachers and 3922 students in the schools. In addition, by factoring in the Digital VAX 11/750 system at Keene High School, with over 45 on-line terminals, the overall district's students per computer ratio is 7.5 to 1.

It should be noted that none of this data includes the number of terminals available in all schools in the district to access the central office mainframe computer which is used exclusively for administrative applications.

CHAPTER IV

MICROCOMPUTERS IN THE PUBLIC SCHOOLS

A MANAGEMENT PLAN

Based on experience and an extensive review of the literature, the essential components of a plan to introduce and manage computers in the public schools include: Planning for organization and implementation; Curriculum development; Staff training; Acquisition of hardware and software; Provisions for support services; and Program evaluation. School leadership personnel must effectively address each of these variable components in order to provide the opportunity for the computer's potential to become a reality for both instructional and administrative applications. The computer, unlike other technologies that have been introduced and subsequently not used, has the potential to improve the teaching and learning process; it has the potential to facilitate learning in the classroom. Unlike other technologies the computer presents a powerful opportunity for change in public school instruction and organization:

Special Note: The readers of this plan should understand that it was developed by a superintendent of schools who was very knowledgeable and who provided the initial leadership for the introduction of technology. To be successfully implemented various aspects of this plan should be done with a clear understanding of the personnel, facilities, equipment, and training that are available.

The Management Plan

This paper will now examine the important elements of the six basic components of a management plan for introducing computer technology into the public schools.

Planning for Organization and Implementation

* The central office administration must present a vision for the organization and implementation of computer education for the district. There should be two plans; one for instructional uses and one for administrative uses. The vision should focus on the improvement of student learning and managerial efficiency for teachers and administrators.

* A comprehensive plan for computer education should be developed for the school district (for use of computers by students and staff).

* The plan should articulate a clear philosophical statement on the use of computers in the schools with a focus on improvement of student learning.

* The development of the plan should involve the active participation of all levels of the organization.

* The individual schools should develop a plan that is keyed to the overall district plan.

* A K-12 Technology Committee should be appointed to oversee all aspects of computer education (and related technologies) for the district and for the individual schools.

* All plans for computer education should be reviewed and revised annually.

* The first step in the development of a plan is to conduct an assessment to determine the extent to which computer hardware and software is currently being used for instructional and administrative applications. The assessment could also be used to identify the type of training programs that personnel in the district have participated in or need. A further use would be to determine future goals.

* The plan should provide the opportunity for experimentation to occur in the various schools, for example, to determine the best location of computers for different purposes.

* The plan should present a definition of what computer literacy means; for the student, for the teacher, and for the school administrative personnel.

* Once a certain critical mass has been reached, a K-12 coordinator for the program should be appointed. This position should report directly to a central office administrator, preferably the superintendent of schools. The responsibilities assigned to this administrative position would include the formulation of a process for the purchase of hardware and software, program articulation, and staff training based on the assessment and input from staff.

(1) For the purpose of this paper computer education means the basic understanding of the operations and potential applications of this technology. For those who will be pursuing this field as a career the term will also mean

a continuum from the very basic operations to advanced programming.

* The definition of computer education should incorporate all the ways that computers and related technologies can be utilized to enhance learning and teaching.

* The members of the board of education must be kept informed and educated on all aspects of the plan. Their continuous support is essential.

* Individual schools should formulate guidelines for student use of microcomputers (covering operating instructions, minimum proficiency requirements, time schedules, and so on). Some schools may award computer operator licenses to students once they have demonstrated a standard of proficiency.

* A set of specifications for the design of microcomputer laboratories should be developed based on the needs identified.

* The school library/media centers are an integral (if not central) part of an effective computer education plan.

* The district plan should outline the variety of ways that the computer could be used for instructional and administrative purposes: (such as word processing, test construction, library circulation, accounting, gradebooks, attendance, and classroom demonstrations).

* Long-range plans should be developed on a 2 to 3 year basis, rather than on for a longer duration, because of the rapid rate of technological developments. This plan should be reviewed annually.

Curriculum Development

* The school district should develop a K-12 skills continuum for computer science instruction (a skills continuum identifies the skills to be taught at each grade level). This continuum should be reviewed annually.

* The skills continuum should be rewritten every two (2) years in order to maintain pace with technological developments. This is due to the fast changes in the development of this technology.

* The four key sections of a computer science continuum include computer awareness, computer operations, computer-assisted instruction, and computer programming.

* Programs in the elementary schools do not need to emphasize computer programming.

* The plan for teaching keyboarding skills should be formulated and implemented in the elementary schools.

* Close cooperation among staff in the elementary, junior high, and high school is essential and is key to effective program development and coordination.

* The responsibility for computer science instruction should not be automatically assigned to the mathematics department.

Professional Development

* Training programs should initially involve school personnel who are interested in utilizing the computer for instructional or administrative purposes.

* Training programs should address the issues of computerphobia or technophobia.

* Trainers need to be sensitive to the emotional reactions of teachers and administrators to the computer and, therefore, structure the training in a nonthreatening manner.

* Workshops for teachers should concentrate on the use of tools programs, software evaluation, word processors, data bases, spreadsheets, graphic utilities, and the like.

* A training model should include continuous and on-site support for neophyte teachers based on their expertise and interest.

* The training should be practical; it should provide the opportunity for hands-on experience.

* A school district should identify its own system "expert" to run training programs and to be available for follow-up questions or problems.

* The training programs should model and encourage experimentation and creativity.

* Staff, involved in training programs should be encouraged to maintain a notebook documenting instructions for all applications studied and for personal notes, evaluations, and comments.

* The training programs should promote a positive attitude of working together, of expecting to need help, of seeking help, and for providing help to others.

* Training programs for teachers should include such topics as: the advantages and disadvantages and appropriateness or lack thereof of using the computer in the instructional process; the compatibility

between doing tasks by computer and using traditional methods; a survey of computer applications in the classroom; the historical development of the computer; understanding the impact the computer can have on the teaching process; and insight into the major problems involved in the integration of computers into education.

* Teacher training programs should not generally emphasize acquisition of programming skills.

* Training programs should provide informal opportunities for personnel to share information.

Acquisition of Hardware and Software

* Criteria for the selection of hardware should be clearly identified. Such criteria should include: warranty information, including availability of continuing support, maintenance costs, availability of software, peripherals, vendor assistance, documentation, amount of sales to other districts, training, installation of equipment, networking potential, and compatibility with other hardware in the system.

* Criteria for the selection of software should be clearly delineated. Such criteria should include: documentation, site licenses, instructional objectives, learning objectives, networking possibilities, support services, accuracy of content, validation, compatibility to software offered by other vendors, operating costs, copyright, and educational value.

* The selection of software for computer-assisted instruction should be related to the skills to be taught at the various grade levels and in the K-12 content areas.

* Initially computer hardware should be standardized across the district to allow for an exchange of software among schools and to promote the most effective maintenance arrangements. This would also allow for the emergency substitution of equipment. As expertise grows this could become more flexible based on applications required.

* The software should be previewed and evaluated on-site prior to making a decision to purchase.

* A software catalog should be developed at the district level for dissemination to all classroom teachers. This catalog should include a brief description of the software, a rating of the software, and the appropriate grade level for use.

Provisions for Support Services

* Create a professional library of resource information.

* Establish a centralized system for preview, evaluation, purchase, storage, and distribution of computer software.

* Establish a process for dissemination of information. it is impossible for any one person to devote the time required to keep up with the developments in computers and other technologies.

* Support and encouragement should be provided for the formation of user groups in the local areas.

* Institute a preventative maintenance program for all computer and peripheral equipment.

* Develop the school district guidelines on copyright information and display in each setting where computers are used. Each staff member needs to understand and support these guidelines.

* Encourage school personnel to participate in local, regional, state, and national conferences on computers in education.

Program Evaluation (Appendix D)

An essential component of the management plan is a system for continuous evaluation. An evaluation plan should initially focus on such factors as (1) effectiveness of inservice training, in particular, the type of training which seems to be the most effective in empowering the classroom teacher to utilize the microcomputer; (2) the percentage of staff participation in training programs; (3) an assessment of both the availability and utilization of computer hardware and software; and (4) a review of the school district's management plan for the introduction to computers in the schools for both administrative and instructional purposes. After a period of 2 to 3 years the evaluation plan should then focus on student learning outcomes and possibly administrative effectiveness.

The formative evaluation plan will provide continuous feedback on all aspects of the management plan so that adjustments can readily be made to improve the strategies and approaches utilized in the various schools. The primary objectives of this evaluation component are to provide continuous in-process feedback; to discover unplanned and unexpected consequences that are resulting from particular program practices; to suggest realistic alternative courses of action

for program modification; to determine and document the underlying policies and administrative procedures that contribute to the success or failure of particular components of the plan; and finally, to determine whether or how effectively the objectives of the program are being fulfilled.

All programs need to be evaluated over time in order to gather information on which to base conclusions and to make recommendations for change. The ultimate question to be answered is to what extent has the application and utilization of computers interacted with the teaching process to improve student learning. This plan focuses on the use of the computer to help do something better; not as an end in itself.

Summary

It is this writer's opinion that the most important element in the successful introduction of computers into the public schools is the classroom teacher. School district leadership personnel must focus on this important person and develop a staff training program that will address the concerns of the classroom teachers about this innovation. Central office administrators and principals should be encouraged to take these courses with the teachers.

To incorporate any new program into an organization successfully requires an effective blending of leadership skills, an appreciation and sensitivity to the process of change, and a knowledge of the elements of the program itself. This careful blending must occur if the program is to become an inherent part of the organization.

Computers in the Schools - A Management Plan

A Summary of Key Steps

1. Needs assessment: analysis of current use and projection of future use/needs.
2. Identify key individuals with leadership skills.
3. Selection of K-12 Computer Education Committee.
4. Selection of hardware, development of bid specifications, and selection of vendor.
5. Development of comprehensive computer education plan.
6. Evaluation of software, preview, purchase, storage, cataloging, and distribution.
7. Development of K-12 Computer Science Skills Continuum.
8. Appoint district K-12 Computer Education Coordinator.
9. Development of training programs for teachers and administrators.

"Do's and Don'ts" of a Computer Education Management Plan

1. Do remember that the computer is an instructional tool; it is not the instructional tool.
2. Do not force teachers to use the computer as an instructional tool.
3. Do start the plan initially with those teachers who are interested.
4. Do utilize teachers and staff as the primary trainers in staff development.

5. Do not allow individual schools to go off on their own; a district level framework is essential.
6. Do allow options on the location of a computers in the school; for example, individual classrooms, computer laboratory, or library/media center.
7. Do obtain the interest and involvement of central office administration who will be essential to the success of a computer education plan.
8. Do offer programs for parents in the evening, open houses during the school day or during school vacations.
9. Do keep the school board/committee participating in and knowledgeable of all activities. Their continued support is essential.
10. Do encourage the teachers to experiment; do allow the opportunity for creativity.
11. Do not purchase software without providing the opportunity for previewing and evaluation by at least 3 or 4 classrooms.
12. Do standardize equipment purchases, particularly during the early stages of implementing a computer education plan.
13. Do not assume that all teachers will be equally motivated or interested.
14. Do centralize the process for purchasing hardware and software. Most companies offer substantial discounts for bulk purchasing.
15. Do not purchase a maintenance contract for all pieces of equipment; the hardware is remarkably trouble free. Train a person at each school site to do repairs.

16. Do install a security alarm system for all computer laboratories.

17. Do not install carpeting (unless static-free) nor allow the use of chalkboards in computer laboratories. Do install white-boards and large monitors for whole class viewing. An alternative to the monitor could be the magnaboard or PC viewer.

18. Do not emphasize skills in programming the computer in staff development programs. More emphasis is now placed on applications such as spreadsheets, data bases, and word processing.

19. Do remember that computers present a powerful opportunity for change in school organizations. Support staff in understanding the various stages in change and how to support change.

20. Do remember that change is a process; not an event.

21. Do incorporate in the management plan a public relations component involving the local media. It is essential to keep the community informed.

22. Do allow the use of computer laboratories for evening adult education programs.

23. Do allow teachers to take computers home on vacations to use for their own work related projects.

TABLE 4.1 Keene School District Technology Long Range Plan Timeline

	1987 - 1988					1988 - 1989					1989 - 1990					1990 - 1991				
	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4
A. CURRICULUM																				
1. Develop every two years	X										X									
2. Redefine K-12 offering of computer courses										X	X									X
3. C.S. Curriculum emphasize applications. De-emphasize programming		X					X					X					X			
4. Assess application of computer as tool in all K-12 subject areas		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X
B. STAFF TRAINING																				
1. Continuous and Multi-Level Courses Offered		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X
2. Introductory courses in Micro's will be a prerequisite for all courses		X		X			X		X			X		X			X		X	
3. Form user group opportunities	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4. Participate in State, Regional, and National Workshops	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5. District workshop day for Technology																				
C. HARDWARE																				
1. Facilities will have a computer in each classroom																	X			
2. Lab setting in each school																	X			
3. Student to Computer ratio: 4/1																	X			
4. Introduce interactive laser disk to each school																	X			
5. Place one or more laser disk systems in each school					X					X										
6. Telecommunications										X				X						
Modems in each lab										X										
Telephone lines in each lab																				
On-line database subscription																				
Compu-Serve Gr. 6-8											X									
Dialog Gr. 9-12											X									
7. Acquire computer projectors for each school site for large group use										X		X	X	X	X					
8. Request for Bid to determine installing dealer		X					X					X					X			
D. SOFTWARE																				
1. Update of software		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X
2. Establish process for preview evaluation, cataloging, storage and distribution		X					X					X								

continued

	1987 - 1988					1988 - 1989					1989 - 1990					1990 - 1991				
	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4	0	1	2	3	4
E. ADMINISTRATION																				
1. Review Long Range Plan		X					X					X					X			
2. Implement Board Policies	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3. Appoint K-12 Computer Education Committee		X										X								
4. Formation of collaborative with area schools											X	X	X	X	X	X	X	X	X	X
5. Local schools formulate plan keyed to overall district plan		X					X					X					X			
6. Support administrative applications to facilitate management of information		X					X					X					X			
7. Establish computer committees at KHS and KJHS					X		X													
8. Building Level Coordinators		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X
F. SUPPORT SERVICES																				
1. Central previewing, ordering and distribution of materials	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2. Grant applications	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3. Centralized professional library & research	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4. Evaluation of new technology	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5. Needs assessment for hardware and software	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6. Each building has a key person trained in Level I maintenance/ release time 1-2 periods a week		X	X	X	X		X	X	X	X		X	X	X	X		X	X	X	X
7. Repair technician - full-time	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8. Centralized process for bulk purchase of hardware and software	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9. Outline copyright statement		X	X				X	X				X	X				X	X		
10. Establish technology policies																				
G. PROGRAM EVALUATION																				
1. Annual evaluation of various elements of program					X					X					X					X
2. Monitor research information and resources	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
H. COMMUNITY EDUCATION																				
1. Community use of labs by business to up-grade employee skills	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2. Establish public information program		X		X			X		X			X		X			X		X	
3. Parent awareness training		X					X					X					X			

KEY

0 - Summer 1 - 1st quarter 2 - 2nd quarter 3 - 3rd quarter 4 - 4th quarter

TABLE 4.2 Keene School District, Keene, New Hampshire - Long Range Plan for Technology in the Schools, 1987-1991

Curriculum Objectives:

- Review and rewrite every two years
- Redefine K-12 sequence of computer science courses
- Meet New Hampshire minimum standards
- CAI (Computer Assisted Instruction) will be proposed for use in all content areas
- C.S. Curriculum emphasize applications - de-emphasize programming
- Assess application of computer as tool in all K-12 subject areas
- Test out offered to students for one-half graduation requirement

Staff/Training Objectives:

- Courses of training will be continuous and developmental
- Courses will be offered at all levels
- An introductory course in computer operation will be the prerequisite for all applications
- Training will place emphasis on application rather than programming
- Staff orientation should provide opportunities for collaboratives and sharing with peers
- Participation in local, state, and regional training opportunities
- Form user group opportunities
- Participate in state, regional, and national workshops
- Training of teachers in classroom management applications
- District workshop day for technology

Hardware Objectives:

- The 3-year goal is to have computers available on a 4 to 1 ratio
- All school facilities will include a computer in every classroom and a central lab
- Cable link for the schools and home and among the schools and Keene State College
- Acquire computer projectors for each school site for large group use
- Establish position of systems manager for computer hardware
- Introduce interactive laser disc systems in each school
- Place one or more laser disc systems in each school
- Telecommunications
  Modems in each lab
  Telephone lines in each lab
  On-line database subscription
  Comp-Serve Gr. 6-8
  Dialog Gr. 9-12
- Request for bid to determine installing dealer

continued

Software Objectives:

- Continuous update of software keyed to K-12 skills continuums
- Establish process for preview, evaluation, cataloging, storage, and distribution

Administration Objectives:

- The Long Range Plan will be reviewed annually and redeveloped as appropriate
- Appropriate board technology policies implemented
- K-12 Computer Education Committee to include teachers, administrators, board members and area college personnel to serve as a clearing house to review all requests for the Computer Education Program
- Formation of a collaborative program with area schools and colleges
- Manager of Instructional Resources to oversee all aspects of the K-12 Computer Education Program
- Local schools formulate plan keyed to overall district plan
- Support administrative applications to facilitate management of information
- Formulate guidelines on confidentiality and access the student records in electronic medium
- Computer Committee - Keene High School and Keene Junior High School
- Building level computer coordinators

Support Services Objectives:

- Center for Instructional Resources, Technology and Training
  + centralized previewing, ordering and distribution of district materials
  + full time repair technician
  + each school will have a trained individual for Level I maintenance
  + identify funding sources and submit appropriate grant applications
  + centralized professional library and on-line research service
  + annual assessment for hardware and software data needs
  + on-going evaluation of new technology available for instruction
  + centralized process for bulk purchase of hardware and software
  + outline copyright statement
  + define role of media generalists positions as key facilitators in application of technology to instruction and research activities
  + establish technology policies

Evaluation Objectives:

- Annual evaluation of some aspects of the program
- Monitor research information and resources

continued

Community Education Objectives:

- To include community use of labs by area businesses to upgrade skills of employees
- Establish public information program

Adopted
K-12 Computer Education Committee
5/13/86

Approved
Keene Board of Education
6/10/86

TABLE 4.3 Proposed Organization Chart

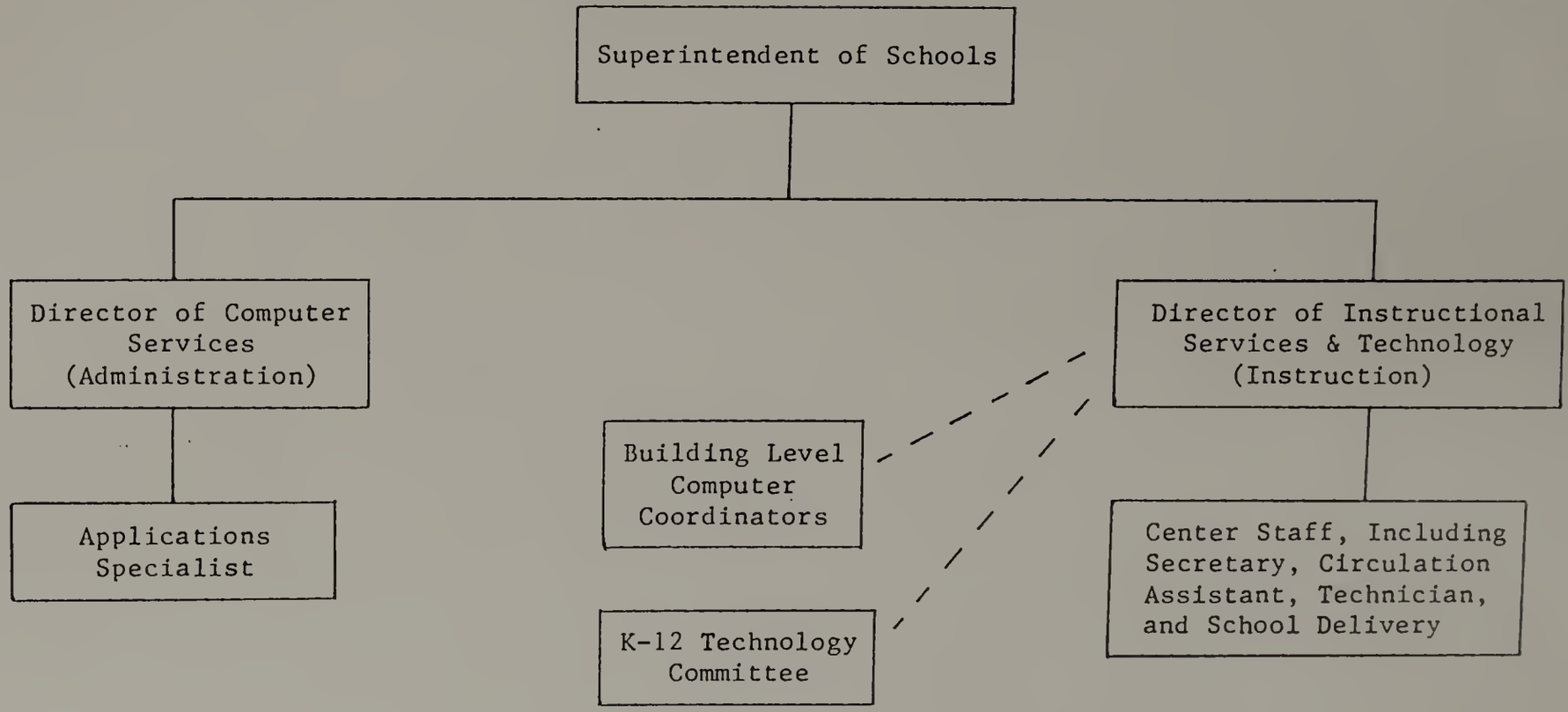

TABLE 4.4 An Information Glossary to Accompany the Management Plan (recommended books, journals, conferences, and organizations)

Planning for Organization and Development:

Loucks, Susan F., Newlove, Beulah W., Hall, Gene, E. (1975). Measuring Levels of Use of the Innovation, The Research and Development Center for Teacher Education. The University of Texas at Austin.

Pogrow, Stanley (1985). Computer Decisions for Board Members. Teach'em Inc. and National School Boards Association.

Merrimack Education Center (1984). Computer Applications Planning. Technology Lighthouse of the Merrimack Education Center: Chelmsford, Mass.

Lockheed, Marlaine E. (1983). Computer Literacy: Definition and Survey Items for Assessment in School. National Center for Education Statistics Under Contract 400-82-0024: U.S. Department of Education.

Curriculum Development:

Merrimack Education Center (1988). Technology in the Curriculum. A Handbook for Integrating Computers and Related Technologies Throughout the Curriculum, 101 Mill Road, Chelmsford, Mass. 01824

Keene School District (1989). K-12 Computer Skills Continuum. Developed by K-12 teaches in Keene (N.H.). Available by writing to Superintendent of Schools, 34 West Street, Keene, N.H. 034341 $10.00.

McCarthy, Robert (1988). Making the Future Work - The Road to Curriculum Integration. Electronic Learning, 8(1). 42-46.

Staff Training:

Lieberman, Ann and Miller, Lynne (1984). Teachers, Their World, and Their Work. Alexandria: Association for Supervision and Curriculum Development.

Hirschbuhl, John (1988). Computers In Education: Third Edition. Guilford, Connecticut: Dushkin Publishing Group, Inc.

Bruder, Isabelle (1989). Future Teachers: Are They Prepared? Electronic Learning, 8(4), 32-39.

continued

Acquisition of Hardware and Software:

Hayes, Jeanne (1988). Microcomputer and VCR Usage in Public Schools. ERS Spectrum. 6(2), 3-8.

Sloane, H.N., Gordon, H.P., Gunn, Carolee, and Mickelsen, Vicki G. (1989). Evaluating Educational Software. Englewood Cliffs: Prentice Hall.

Jones, N.B. and Vaughan L. (1983). Evaluation of Educational Software - A Guide to Guides. U.S. Department of Education: The Northeast Regional Exchange Inc.

Provisions for Support Services:

American Association of School Administrators (1984). High Tech for Schools (Report No. 021-00122). Alexandria.

Montana Task Force on Computer Education (1983). The Elements of Computer Education. Helena, Montana: Office of Public Instruction.

Program Evaluation:

Smith, R.M., Diercks, E., Molek, R., Rutherford, J., and Waldorf, J. (1988). Comprehensive Use of Technology Leading to Excellence in A School District. ERS Spectrum. 6(2), 23-29.

Martinez, Michael E. and Mead, Nancy A. (1988). Computer Competence: The First National Assessment. Princetown, New Jersey: (Report NO. 17-cc-01) Educational Testing Service.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

In this chapter we will explore the use of the plan, the importance of leadership, further research questions, the future, and conclusions and recommendations.

The Use of the Management Plan/Leadership

The management plan presented in this paper will be continually evolving as we learn more about the impact of technology on teaching, learning, and the operation of schools. The plan is intended to be used as a guide by the school superintendent or school principal to monitor the various activities associated with the implementation of this technology into the schools. Specific targets/timelines could be established.

By itself the plan is not a recipe for success. It is not a set of sequential steps. The plan is highly interactive requiring a number of events and processes to occur concurrently. It requires a leader willing to take risks, a leader willing to set a vision, a leader who will encourage experimentation and creativity to occur in in the classrooms. A leader who will be able to provide the necessary resources and services required. The plan requires a leader who is flexible.

The plan should not be imposed on an organization. Careful consideration must be given to those factors reviewed in Chapter II: leadership, change process, group process, and the innovation itself.

One recent study found that while ninety six percent of the nation's school districts were using various kinds of technology, only fourteen percent had developed policies about how they were going to use the technology (Time for Results, 1986: refer to page 44). The section of this report on technology, prepared for Governor John Sununu of New Hampshire, focused on the policies and programs that encourage effective use of technology in the classroom. The report indicated that not enough school districts are planning their use of technology.

Technology management structures the orderly, cost effective, and educationally valid use of technology in the educational setting (Hill, 1988). Hill warns that we need to -"Manage technology! Don't let technology manage you!" Hill proposes that successful technology management ensures that each step toward technology use supports an educationally appropriate and definable goal. Only when educational goals are well defined and technology is selected to support those goals can successful learning environment be planned and designed (Hill).

Further Research Questions

"Time for Results," which was developed by the national governors group has suggested that what has been spent for research and development is scattered and does not focus on the needs of the students or teacher. Research must identify the materials, resources, and supports that will help teachers in regular school settings to use new technologies and guide students' inquiry effectively (Educational

Technology Center, 1988). What don't we know, what are the gaps, what should be the new horizons, or new theses?

There are a number of research questions that should be investigated.

1. What is the relationship of teacher skills in the use of technology in various subjects to improved student achievement?

2. What is the relationship of effective leadership in technology to improved student outcomes?

3. What are the relationships of certain types of teacher training activities to results in an increase in the productive use of the technology as an instructional tool?

4. How does the use of technology impact on student thinking and achievement?

5. What should be taught? How can we promote equitable opportunities of instruction and access? How can we help teachers to be more effective in this domain? (Martinez and Mead, 1988). What is the impact on various student groups?

6. What subject areas are most effectively taught through the use of computer technology?

7. What type of school design would enable us to make the best use of technology?

8. How has the use of technology in the Keene School District improved student outcomes?

Other research questions could address such issues as equity, standards and accountability, special education populations, and the role of the private sector.

The Future

Nationally, the average micro-pupil ratio fell 74 percent between 1983-84 and 1987-88 from one micro per 125 students to one micro per 32 students; 74.8 percent of all high schools have more than 10 computers; virtually all school districts with more than 1000 students have a district level microcomputer coordinator; in the fall of 1987 there were 1,253,486 microcomputers in public schools (ERS Spectrum, 1988). The largest year-to-year increase was between 1982-1983 and 1983-1984 when over 30,000 schools became microcomputer users (Market Data Retrieval, 1987).

This data confirms that microcomputers have become a permanent part of day to day instruction in the public schools. The technology is not supplemental; it is an integral part of what schools are trying to accomplish (Mecklenburger, 1987). The challenge now for this nation's educators is to use these tools to their full potential.

In entering the computer age, American education has truly come a long way in a short time, but the path ahead looms with challenges and possibilities that can only be imagined (Martinez and Mead). The future of technology will be the integration of new versions of computers, copiers, networking facsimile, software, work stations, facilities management, videotape players, satellite transmission equipment, digital televisions, robotics, laser disc equipment, video cassette recorders, videodiscs, remote controls, electronic mail, audiocassettes, and digitized tapes.

Discussion and Recommendations

This study has extended existing knowledge by the application of research information, as summarized in the literature review for this study, and by the review of a selected group of individuals. It is expected that the components of the computer management plan would be very useful to school districts now embarking on an effort to introduce computers into the schools. This study will be useful to each of the school principals in the Keene School District in designing intervention strategies to improve the utilization and application of computers in the schools.

This study could form the basis for more comprehensive longitudinal types of investigations in either the Keene School District or in other school districts. This study has attempted to look at the broad array of issues associated with the management of computer technology in the public schools. It has attempted to identify the major issues associated with the management of computer technology in the public schools. It has attempted to identify the major issues that school administrative personnel and classroom teachers should be aware of in embarking on a plan to introduce computers in the schools. Each of the six major components of the computer management plan outlined in this study could become a topic for more intensive investigation.

Young (1984) asks the question: "What wonders of the world will my students miss out on because their administrator wasn't aware of the necessary curriculum for the computer age?" What should every

administrator know about the high tech, information systems, and the like? And finally, Roblyer (1985) suggests that one of the great unanswered questions in education is: "How much do computers actually improve instructional methods, and consequently, student achievement?'

In Chapter I this writer referred to three main uses of the computer: as a management tool for administrators and teachers; as an object of study; and finally, as an instructional tool. Extensive research remains to be done to assess the effectiveness of the computer in each of these domains. However, this writer feels that we can be very confident about the positive outcomes for the first two uses. The research on the effectiveness of the third domain will need to focus on the most important question of all -- How has the use of the microcomputer in instruction improved the achievement level of students?

APPENDIX A

Protocol for Reviewers

SCHOOL ADMINISTRATIVE UNIT NO. 29
JOHN W. DAY EDUCATIONAL CENTER
34 WEST STREET
KEENE, NEW HAMPSHIRE 03431

Dear

Computer technology now impacts on every aspect of society. As a result of this factor the issue is no longer whether or not school districts should respond; but rather, by what process should we manage this technology in our schools.

I am currently enrolled in the doctoral program at the University of Massachusetts. My dissertation topic is a study of the process that superintendents should follow in formulating an effective organizational response to the management of computer technology in the public schools. Essential to the study is your completion of the enclosed survey. The purpose of the survey is to collect information on the current status of management practices associated with the introduction of computer technology in the public schools.

I apologize for this intrusion on your time. Hopefully, the topic of my study will be of sufficient interest to you to warrant the time that will be required for the completion of the survey. My study will be greatly assisted by a high percentage of return.

Please return the survey in the enclosed envelope no later than **May 15, 1988.** Upon receipt of the survey, I will mail to you a Tri-State Megabucks ticket in your name.

In appreciation for your time I will forward to you a synthesis of the results of my research study. In addition, I would be very willing to provide any technical advice you may request to facilitate your efforts to effectively manage computer technology in your school district.

Thank you.

Sincerely yours,

H. Charles Larracey
Superintendent of Schools
N.H. School Administrative Unit 29

HCL:md

Enc.

SCHOOL ADMINISTRATIVE UNIT NO. 29
JOHN W. DAY EDUCATIONAL CENTER
34 WEST STREET
KEENE, NEW HAMPSHIRE 03431

June 2, 1988

Dear

Recently I mailed to you a management plan for technology in the schools. I had requested that you review it and fill out an accompanying survey form. The response date was May 15, 1988.

I am writing again to ask you to please respond to the survey. If it has been lost I would be willing to remail the original packet to you (1-603-352-0820 or 1-603-352-1572).

Your response would be incorporated into my dissertation (UMASS) which is a study of the process that school leadership should follow in formulating an effective organizational response to the management of computer technology in the public schools.

Please respond by June 15. Thank you for your assistance.

Sincerely yours,

H. Charles Larracey
Superintendent of Schools
N.H. School Administrative Unit 29

Note: Upon receipt of the survey. I will mail to you a Tri-State (New Hampshire, Vermont, and Maine) Megabucks ticket.

HCL:md

REVIEWER REACTION SHEET

MICROCOMPUTERS IN THE PUBLIC SCHOOLS

Please review the enclosed plan by no later than May 15, 1988, to enable me to use your comments to rewrite the proposed Management Plan. Please send this reaction sheet to Mr. Charles Larracey, Superintendent of Schools, School Administrative Unit 29, 34 West Street, Keene, New Hampshire 03431

Prior to your responding to this reaction sheet you may wish to contact me if you have questions or need clarification (1-603-352-1572) or (1-603-352-0820).

I. In general, how do you react to this plan? How useful would it be to yourself or to key people in school districts?

_____ Very Useful _____ Of Some Use _____ Not Very Useful

PLEASE EXPLAIN:

II. Please identify places where additions, deletions or clarification would make this plan more useful. Please comment about each section of the proposed management plan:

- SECTION A: PLANNING FOR ORGANIZATION AND IMPLEMENTATION

- SECTION B: CURRICULUM DEVELOPMENT

- SECTION C: STAFF TRAINING

- SECTION D: ACQUISITION OF HARDWARE AND SOFTWARE

- SECTION E: PROVISIONS FOR SUPPORT SERVICES

III. What personal experiences, triumphs, frustrations; what local district efforts and documents; what concepts or political issues occur to you, as you reflect upon computers and their impact on the operations of schools? (Please feel free to expand your thoughts on to additional sheets or to send documents.)

IV. Are there other revisions that you would propose for the plan to make it more useful?

V. Please rate your knowledge on computer technology: 1 Novice ____

2 ____ 3 ____ 4 ____ 5 ____ 6 ____ 7 ____ 8 ____ 9 ____

10 Expert ____

VI.

Your Name_____

Title_____

Address_____

Telephone Number_____

Thank you.

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Watt, Molly
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603-588-6734

APPENDIX B

Interview Format

INTERVIEW FORMAT
COMPUTER TECHNOLOGY

Name _____

What degree(s) have you earned?

Degree _____ Year Earned _____ Field _____

Degree _____ Year Earned _____ Field _____

How many total years have you been in education? _____

Are you a "Hands On" user of a microcomputer or terminal? Yes ____ No ____
If yes, what microcomputer or terminal do you use? _____

Please rate your knowledge on computer technology.
1 Novice __ 2 __ 3 __ 4 __ 5 __ 6 __ 7 __ 8 __ 9 __ 10 Expert __

Please check any of the following sources of computer and technology information that you utilize?

__ Computer Coordinators __ Computer Dealers __ Peers __ Conferences

__ Department of Education __ Electronic Bulletin Boards __ Other

OPINION STATEMENTS

Please check the box that best reflects your feelings regarding the following opinion statements:

Yes	No	No Opinion	
___	___	___	The technology training provided by our school district has benefited me.
___	___	___	The technology training provided by our school district has benefited my teachers.
___	___	___	The technology training provided by the State has benefited me.
___	___	___	The technology training provided by the State has benefited my teachers.

Yes	No	No Opinion	
___	___	___	Our students should have more access to computers.
___	___	___	Teachers should be encouraged to purchase their own computer.
___	___	___	The school district should help subsidize the purchase of computers for teachers.
___	___	___	The State should help subsidize the purchase of computers for teachers.
___	___	___	More computers should be placed in the classroom.
___	___	___	Each teacher should utilize a computer in the classroom as a teaching/presentation tool.
___	___	___	Computers should be utilized across the entire curriculum.
___	___	___	Teachers do not have the time to learn how to utilize computers.
___	___	___	Teacher training programs are not sufficient to train teachers to utilize a computer in the classroom.
___	___	___	Teachers have plenty of opportunities to learn how to integrate computers into their classroom.
___	___	___	The application of computer technology in our school is helping our students to learn.
___	___	___	Teachers should receive "recertification credits" for courses designed to teach them how to utilize computers in their classrooms.
___	___	___	Computers enhance my school's productivity.
___	___	___	Teacher productivity is enhanced by their personal use of computers.

I believe the implementation of computer technology into our classrooms resulted in changes in teaching styles? Yes ____ No ____

If yes, How do you see your students benefiting from these changes? _____

_____

_____

_____

What is the most exciting use of computer/technology in your school? _____

_____

_____

_____

DIRECTIONS: PLEASE RESPOND TO THE FOLLOWING QUESTIONS BY CIRCLING THE APPROPRIATE RESPONSE (Y = YES, N = NO, OR U - UNSURE).

		RESPONSE		
1.	Our School District has made a firm commitment to the use of computers by students.	Y	N	U
2.	A knowledge of computer programming will be an essential skill for the future.	Y	N	U
3.	Our district has established a procedure for the evaluation and selection of computer software.	Y	N	U
4.	A sequential K-12 program for computer science instruction has been developed for our school district.	Y	N	U
5.	Our School Board(s) have adopted a policy statement on computer technology in the schools.	Y	N	U
6.	A transformation of education is occurring that will change the emphasis from print medium to electronics	Y	N	U
7.	Microcomputers will be an essential instructional tool for the future.	Y	N	U
8.	All students should become computer literate.	Y	N	U
9.	The "Basics" of tomorrow will be the skills that today are considered to be of a higher level.	Y	N	U
10.	The new information technologies will prompt massive changes worldwide and it is paramount that we develop strategies to implement the new technologies in our schools.	Y	N	U

11. The decision on the selection of software is made on the basis of skills to be taught at particular grade levels. Y N U

12. The person or persons most responsible for the introduction of computers into your school have been (rank order from 1 to 7 with #1 - Most Important). Y N U

Teacher _____

School Board _____

Parents _____

Students _____

Principal _____

Central Office _____

Other (specify) _____

13. There are a variety of ways that the microcomputer could be used in the educational process. Place a checkmark ("v") next to the applications that have been used in your school.

_____ Drill and practice

_____ Computer programming

_____ Research via data bases

_____ Computer-videodisc learning

_____ Simulations

_____ Word processing

_____ Creating art

_____ Composing music

_____ Computations in science & mathematics

_____ Computer literacy

FROM YOUR EXPERIENCE WITH USING COMPUTERS IN YOUR SCHOOL LEARNING, WHICH OF THE FOLLOWNG HAVE YOU FOUND TO BE PROBLEMS?

		A Problem	Not a Problem
14.	Lack of access to terminals or microcomputers	_____	_____
15.	Lack of student interest	_____	_____
16.	Low quality of educational software	_____	_____
17.	Reallocation of funds to computers from more pressing needs	_____	_____
18.	Difficulty with integrating computer-taught skills with the remainder of the curriculum	_____	_____
19.	Difficulty with managing student use of computers	_____	_____
20.	Lack of teacher or staff training	_____	_____
21.	Lack of teacher or staff interest	_____	_____
22.	Lack of administrative support	_____	_____

FROM YOUR EXPERIENCE WITH USING COMPUTERS IN TEACHING AND LEARNING, WHICH OF THE FOLLOWING HAVE YOU FOUND TO BE AN ADVANTAGE?

		An Advantage	Not An Advantage
23.	Providing immediate feedback	_____	_____
24.	Having great patience	_____	_____
25.	Keeping the learner actively involved	_____	_____
26.	Providing self-paced instruction	_____	_____
27.	Keeping records of student performance	_____	_____
28.	Providing, through simulations, experiences otherwise not prossible in the classroom	_____	_____

29. Which of the following changes have occurred as a result of the use of computers in your school?

____ Content of courses

____ Grouping of students

____ Pacing of instruction

____ Pedagogical technique

____ Time for individual attention

____ I do not use computers in class

____ There have been no changes

30. Does your school have written goals for students' computer literacy?

____ Yes, in place

____ Yes, in progress

____ No

____ Don't know

31. How are computers used to support instruction in your school?

____ Used for teaching and learning

____ Used for instruction in programming

____ Used as a tool in various subjects and courses

____ Used for computer-managed instruction

33. In your school are there <u>specific rules</u> that govern any of the following: Check all that apply:

____ Protecting equipment from damage

____ Protecting equipment from loss

____ Destroying another person's data

____ Disrupting the operation of the computer

____ Scheduling or sharing equipment

____ Scheduling or sharing programs

____ Copying copyrighted programs

____ Copying other students's graded computer work

PLEASE CAREFULLY LISTEN TO THE FOLLOWING STATEMENTS AND RESPOND BY RESPONDING 1, 2, 3, 4, OR 5 TO INDICATE THE DEGREE TO WHICH YOU AGREE OR DISAGREE WITH EACH STATEMENT:

KEY: 1 = Strongly Disagree
2 = Disagree
3 = Undecided
4 = Agree
5 = Strongly Agree

34.	Computers are valuable tools that can be used to improve the quality of education.	1	2	3	4	5
35.	Computers should be used by schools more than they are now.	1	2	3	4	5
36.	A school system should buy all other educational materials before purchasing computers.	1	2	3	4	5
37.	A computer is an unnecessary luxury in most school settings.	1	2	3	4	5
38.	Computers are of little value in education because they can be used to teach only one or two subjects.	1	2	3	4	5
39.	Computers are of little value in the classroom because they are too difficult to use.	1	2	3	4	5
40.	Teachers should know how to use a computer in the classroom.	1	2	3	4	5
41.	Computers are a danger because they dehumanize teaching.	1	2	3	4	5
42.	I would like to attend inservice training on computer use in education.	1	2	3	4	5
43.	Computers provide motivation for students to learn.	1	2	3	4	5

44. All students should learn about computers and how to use them as problem-solving tools. 1 2 3 4 5

45. Computers in schools have an adverse effect on students. 1 2 3 4 5

46. Give your best estimate of the following ratios by the year 1990 for your school.

Teachers per computer _____

Students per computer _____

47. Listed below are some ways teachers use or teach about computers. Please indicate those activities that currently take place in your school and those activities that are being planned in your school.

Use	Computer Activity	Current Use	Future Plans	Don't Know
	For numerical calculations	o	o	o
	To run simulations	o	o	o
	For instructional games	o	o	o
	As leisure time activity and reward	o	o	o
	For student problem solving	o	o	o
	For drill-and-practice	o	o	o
	As a tutor (teach content)	o	o	o
	To demonstrate concepts	o	o	o
	To score tests	o	o	o
	As an instructional management aid	o	o	o
	As a material generator (tests or worksheets)	o	o	o
	For information retrieval	o	o	o
	For student analysis of data	o	o	o
	For word processing	o	o	o
	For special needs students	o	o	o
	To control laboratory equipment	o	o	o

48. Where have you received any computer training? Check all that apply:

___ University

___ College

___ Vocational-Technical School

___ Community College

___ Community Education Program

___ District Inservice Program

___ Educational Computer Consortium

___ Computer Store

___ Computer Camp

___ Industry

___ My training has been self-taught

___ I have not received any computer training

___ Other_____

THANK YOU

Some of the Interview Questions Adapted from:

Computer Literacy: Definition and Survey Items for Assessment In School
National Center for Education Statistics
September 1983
NCES 84-203
Marlaine Lockheed, Project Director

APPENDIX C

Governor's Initiative

for

Excellence In Education

STATE OF NEW HAMPSHIRE
OFFICE OF THE GOVERNOR
CONCORD 03301

JOHN H. SUNUNU
GOVERNOR

GOVERNOR'S INITIATIVE FOR EXCELLENCE IN EDUCATION

It is the purpose of the Governor's steering committee to develop a comprehensive program which, in accordance with HB 421 FN, will promote excellence in education in the Granite State by improving and modernizing teaching and by providing greater opportunities for all students in Kindergarten through Grade 12. During the first phase, the effort will focus on three major areas:

1) Development and expansion of programs for gifted and talented students, using resources at all levels, as appropriate, and drawing upon the work already started in that field;

2) Development of a program to improve teacher effectiveness and streamline classroom activities through the use of computers; and

3) Enhancement of educational opportunities for students in all parts of the state through the application of technology in the classroom.

To assist the steering committee there will be an action committee appointed in each of the three areas of examination. The action committees will advise the steering committee by providing technical and professional support. The steering committee has charged the action committees as follows:

GOVERNOR'S EXCELLENCE IN EDUCATION PROGRAM

A. Action Committee on the Gifted and Talented

The primary focus of this committee will be to assist in the establishment of model programs, and the expansion of existing programs for the improvement of the quality of eduation for gifted and talented students in New Hampshire.

The programs should build upon the work already under way at the state and local levels in education and reach students in grades K - 12. The project should include efforts to increase the depth and the breadth of opportunities for children. The committee shall consider programs to support teacher training as a means to provide opportunities for many children over a long period of time, as well as specific programs tailored to meet local priorities.

The committee will help examine ways that communities can promote the interest and involvement of resources such as colleges and universities, business and industry, and community facilities (libraries, historical societies, hospitals, music groups, museums, etc.) toward the full development of the talents of the affected students.

B. Action Committee on Technology in the Classroom

The primary focus of this committee will be to assist in finding ways to use technology to improve the quality of instruction, thereby encouraging more effective learning and more effective teaching for students of all abilities. The committee will help explore uses of modern communications tools for reaching students in a variety of situations. Tools such as computers, interactive TV networks, and laser disks will be considered. This committee will work with appropriate specialists to acquaint the steering committee with the kinds of tools that are becoming available and the possibilities for application in the classroom. The action committee will assist in addressing situations such as the following:

*Even a superb teacher is not at his or her best every hour of every day or in every aspect of a subject. Through the use of technology there may be ways to bring "the best of the best" to students throughout the state.

*Through the use of technology, schools will be able to provide a broader or a more advanced level of study for students that would not be feasible otherwise. This study could be offered as a supplement to existing study or as a separate course.

*There may be times when a particular chemistry or physics

applications of computers could also be valuable time-savers for teachers.

*In conjunction with equipment such as videodisks and videotapes, computers can be used to broaden the resources that the teacher has available to make presentations to students.

*Computers could be used to perform many of the repetitious tasks that are part of instruction, but nonetheless consume time. For instance, a music teacher could use a computer to print out the notes of a piece of music rather than taking the time to write them on the chalkboard.

*Computers offer the opportunity for individualized student instruction allowing the teacher to step back and examine the different learning styles of instruction. By knowing how each student learns best, the teacher can become a more effective learning coach.

The committee will consider programs to support the development of model plans in various sized schools, at various levels. The committee will view the use of computers in the classroom as a means to an end, <u>not the end itself.</u>

laboratory experiment is too dangerous, too monotonous, or too costly to offer in a regular classroom setting but would lend itself to a different type of instruction. There is a role for technology in certain types of scientific inquiry.

The committee will explore, and make recommendations, on ways to use technology to bring the most effective teaching possible into every public school classroom in New Hampshire. Model programs will be considered for development at various levels in various sized schools.

GOVERNOR'S EXCELLENCE IN EDUCATION PROGRAM

C. Action Committee on Computers for the Teacher

The primary focus of this committee will be to assist in identifying ways in which computers may enhance teacher skills to make teachers more effective. The committee will help in the examination of ways that computers can become useful tools for the teacher. For example:

*Computers could assist the teacher with mechanical, time-consuming tasks such as record keeping, attendance, grading, ranking, preparing tests. The computer could also enable the teacher to keep track of student progress in every area of instruction on an individual basis. The word processing

APPENDIX D

Program Evaluation

Indicators

COMPONENT

INDICATORS

1. Organization & Implementation.
   - A 2-3 year plan developed and implemented.
   - School board demonstrates support for long term planning.
   - Individual schools have technology plan.
   - K-12 Technology Committee appointed.
   - Employment of K-12 Technology Coordinator.

2. Curriculum Development.
   - Skills have been identified for each grade level.
   - K-12 sequential continuum in place.
   - Continuum revised every two years.
   - Continuum has more emphasis on applications, less on programming.

3. Professional Development.
   - Training programs available at various skill levels for all staff.
   - Training primarily offered by peers.
   - Training provides for sharing of practical ideas.
   - More than 50% of staff participate in training during first year of plan.

4. Acquisition of Hardware.
   - Criteria for selection of hardware identified.
   - Hardware standardized during first phase of technology plan.
   - Standards for equitable distribution of hardware established.

5. Acquisition of Software.

   - Criteria for selection of software identified.
   - Criteria for purchase of software curriculum driven.
   - Copyright standards clearly established.
   - Software previewed prior to purchase.
   - Catalog of software developed and distributed to staff.

6. Support Services.

   - Professional library available.
   - User groups developed throughout district.
   - Preventative maintenance program in place.
   - Participation in workshops for technology in education.

7. Program Evaluation.

   - Formative and summative plans established.
   - Focus of plan on improvement of student achievement.
   - Data used to modify technology plan.

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